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Western Hog JOURNAL

Message from the editor

I'm excited to present our special summer edition, For the Love of Science! We did a similar feature two years ago showcasing some of the nation's top swine researchers. The first time we went with a science theme, I really wasn't sure how many would participate, and whether it would be our readers' cup of tea. But we received such good feedback on it, and it allowed me the opportunity to get to know other facilities and people in the industry I'd never even heard of before.

This year we received such a tremendous response that we were able to dedicate our entire issue to the research – and the researchers – that dedicate their lives to making ours easier. It can be really easy to forget what an integral role they play in our industry, and how important it is to make sure we keep building bridges throughout our communities within the industry.

While this issue is all science, the fall issue is already shaping up to have cover some hot industry issues with the accuracy and vigour you've come to expect from the Western Hog Journal. Look for stories originating from Ontario, Manitoba, Saskatchewan and Alberta in our next edition, and don't forget to send in your photos from all of the pork-related summer events in your province. It's great to hear from folks who do such a wonderful job serving as ambassadors not just for pork production, but for agriculture as a whole. We're all in this together!

In parting, we apologize if this issue is late in reaching you. As we prepare to go to press, a possible Canada Post strike looms, and if it happens, that could mean a delay before this issue hits the street. For future reference, please email me if you would like to be added to a list to also receive a digital copy of the Western Hog Journal.

I look forward to seeing everyone at all of the upcoming events throughout the summer, and into the fall and winter. As always, please continue to contact me with your suggestions and feedback. Have a safe summer, and see you in the fall! ■

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News and Views from Far and Near

Robert (Bob) L. Ross scholarship open for applications

This year farmers have two opportunities to win the Robert L. Ross Memorial Scholarship to attend the CTEAM program.

CTEAM stands for Canadian Total Excellence in Agricultural Management and is run by Agri-food Management Excellence. During the program, farmers learn detailed financial, marketing and human relations management skills, using their own operation as a case study.

Robert (Bob) Ross was instrumental in guiding the CTEAM program, inspiring and encouraging farm management excellence across Canada

through his leadership and passion for the agricultural community. Bob fought a courageous battle with cancer, passing in March 2014.

As a tribute to his passion, leadership and legacy, Agri-Food Management Excellence, Farm Management Canada, Family Farms Group and the Ross Family, along with an additional private contributor this year, established the Robert L. Ross Memorial Scholarship program, rewarding two farmers with the opportunity to participate in the CTEAM program and continue on a path towards excellence, as inspired by Canada's leading experts and a one-of-a-kind support network of peers and colleagues.

This year there will be two scholarships of \$8250 CAN, which are to be applied towards CTEAM tuition and travel. The successful applicants can choose to attend CTEAM starting in January 2017.

Applicants must be more than 21 years of age and possess passion and devotion to excellence in farm business management. See the application for a complete list of requirements. The deadline for scholarship applications is

Sept. 15, 2016. Applications can be downloaded at www.agrifoodtraining.com.

Innovad appoints Agribution

INNOVAD NV/SA (Antwerp, Belgium) and AGRIBUTION CANADA LTD. (Steinbach, Manitoba) have announced that Agribution will market and distribute the Innovad product line in Western Canada.

"We are excited to add a strong product line like Innovad to our growing product portfolio as we develop our business," said Norm Paisley, president of Agribution. "Innovad is a highly regarded leader in the development, manufacture and distribution of specialty feed additives throughout the world."

"Innovad looks forward to working closely with Agribution as we further develop our product offering in Western Canada," said Ben Letor, Director of Innovad. "Agribution's philosophy of connecting value with performance as a trusted partner in the marketplace aligns well with our core values of working with people and creating trust."

Innovad develops, manufactures and markets innovative additives for the global animal feed, aquaculture, and pet food nutrition sectors. Innovad manages all their manufacturing from a single location in Belgium and supplies their products in over 45 countries. Innovad has built a business that embraces openness, shares ideas and opens up innovation in a sustainable and profitable manner.

Agribution Canada Ltd is a new company located in Steinbach, Manitoba that specializes in the sourcing, marketing and distribution of products for livestock production. Agribution serves the livestock industry through a business-to-business sales channel.

Jim Haggins joins Design Concrete Systems

Jim Haggins of Calgary is the western Canadian representative for Design Concrete Systems Ltd. of Seaforth, Ontario. Design Concrete Systems is a family owned business that has been manufacturing concrete hog slats for over 30 years. Their special design provides CSA-certified slat-

CONTINUED ON PAGE 8

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Jim Haggins

ted floors for hog barns. The slats are manufactured using epoxy-coated re-bar and post and beam modular system for strength and durability. In addition, the holes are hand-finished for ideal hoof health and reduced incidence of injury. The design slats have the highest percent of openings for cleanliness and are available in up to four-foot widths and 6 - 14 foot lengths. They have recently completed delivery of their first order at a very competitive cost. Jim can be contacted at 403-796-7675.

Infinitely control feed levels with new wet-dry feeder

As finishing hogs get heavier, equipment has to as well, and Canarm AgSystems is responding with a new wet-dry finisher that is built to last and with 15 inch feeding holes for heavier hogs.

Added headroom also allows larger pigs to feed comfortably. The feeder has a low 4.75 inch front lip that combines with wide feed spaces to provide optimal feed access and minimum waste. The wide feed space allows pigs to eat straight at the feeder rather than at an angle that can block feed spaces.

The feeder is build strong, with 304 stainless steel, fully hemmed edges and reinforced corners to withstand constant use by finishing pigs.

The wet-dry feeder offers the patent-pending R Adjust™ with infinite

ability to control feed levels which helps farmers maximize feed costs and consumption across the production system. The R Adjust mechanism is infinite in its control, with no ratcheting or clicks, therefore it is will last longer than other feed control mechanisms on similar feeders.

The feeder is 36 inches tall, which gives it significant hopper space, and custom heights are available depending on individual needs.

The new feeder comes in four sizes, 30 inches, 45 inch, 60 inch and 75 inches, which range from two to five feeding holes per side.



Francis Pouliot joins Ro-Main

Ro-Main, a leader in specialized swine technologies, is pleased to announce that Francis Pouliot has joined its team as product manager.

Francis holds an Agricultural Engineering Degree and an M.B.A. from Laval University. His previous work at the Centre de développement du porc du Québec (CDPQ) and at Olymel has given him strong experience in swine building design and technology transfer. With his 20-plus years of experience in the pig industry, Francis will now help Ro-Main pursuing its deep-rooted goal of improving profitability and

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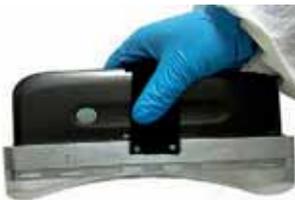
safety of pig producers around the globe.

As the product manager of an innovation-driven company, Francis will make sure that all Ro-Main's current and future products are addressing real-life issues and bringing added value for the client. In that regard, Francis is looking forward to hearing about your product needs to make swine production more profitable and safe in this period of great changes in our industry.

To contact Francis Pouliot: francis.pouliot@ro-main.com, (418) 889-0566.

Wireless loin muscle scanner

SEC REPRO Inc. is now offering a Wireless back fat and loin linear 3.5 MHz, 180 mm probe running on a iPad. Depth can vary from 40 to 200 mm. The weight of the device is 350g



and the battery lasts four hours. Measurement can be automatic or manually adjusted. Visit www.secrepro.com or call 888-446-4647.

Boehringer Ingelheim (Canada) Ltd., receives approval for Metacam® for Swine

Boehringer Ingelheim has obtained approval for Metacam® for Swine (active ingredient: meloxicam 5 mg/ml) with a new indication for the relief of post-operative pain associated with minor soft tissue surgery such as castration in pigs.

The marketing authorization was granted based on a large body of evidence for the efficacy of Metacam generated earlier by the Faculty of Veterinary Medicine at the Ludwig-Maximilians University in Germany. It demonstrated that Metacam administered at 0.4 mg/kg bodyweight prior to the castration of less than seven day old piglets had a significant impact on blood cortisol levels, a biochemical marker for the neuro endocrine reaction of the body to stress and pain. The study also demonstrated quicker alleviation of clinical symptoms and faster return to normal behaviour in piglets that received Metacam in comparison to animals that were not given analgesia.



Metacam for Swine is a non-steroidal anti-inflammatory drug of the oxicam class. It is a potent NSAID given as a single injection of 0.4 mg/kg bodyweight (0.1 ml/1.25 kg) by the IM route. Metacam for Swine should be administered 30 minutes before minor soft tissue surgery such as castration, and has a five-day slaughter withdrawal for pigs.

For more information, contact your veterinarian or email eldon.hartwick@boehringer-ingelheim.com.

ESF feeds sows with precision

Phase two of a multi-year study on Precision Sow Feeding (PSF) led by Dr. Kees DeLange at the University of Guelph has received base funding from Ontario Pork and will examine the value of precision sow feeding and its financial, reproduction and environmental impacts.

CONTINUED ON PAGE 10

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Phase one of the multi-year University of Guelph study on Precision Sow Feeding (PSF) has proven the potential value of feeding sows with a commercial-level, precision, electronic sow feeder (ESF).

Phase one validated the Canarm AgSystems SowChoice Precision ESF equipment in a trial with 140 gilts. Phase Two will continue to follow sows over a second and third parity and prove the value of precision sow feeding in reducing feed costs, improved sow health and productivity. This is achieved through the management of nutrients to precisely match the sow's requirements in each stage of gestation. Rations can be less expensive but more effective because what the sow is fed individually targets nutritional requirements to match NRC recommendations, which can mean lower use of expensive feed ingredients,

and lower cost ingredients for satiety. Matching nutrient requirements to each sow means manure available to farmers for crop production will be more tailored to reducing the environmental footprint.

Researchers have shown the value of precision sow feeding in reduction of feed costs, but the difference in the University of Guelph study is that it is using a commercially available precision ESF unit.

Canarm AgSystems' SowChoice Systems ESF is operating daily on farms in Canada and the United States and is known for its North American construction, and industry leading innovation with standard 304 stainless steel construction, industry first low voltage electrical operated actuators and seamless integration with the worlds largest swine management software PigCHAMP .

The company has worked with Dr. Kees de Lange and graduate student Quincy Buis to fine-tune PSF option to the ESF. It can now dispense changes to



rations in seven-gram increments, depending on the ingredient. The Canarm AgSystems precision feeding ESF allows farmers to blend up to four different ingredients and vary rations daily if necessary.

The interest in precision sow feeding at the University of Guelph also evolved from the changes to the NRC requirements for gestation sows in 2012. The NRC models are the

standards by which rations are formulated for sows.

"The objective of the Canarm AgSystems ESF being used for the research trials is to further integrate data between the NRC Model, daily data changes in the PigCHAMP Management Software, and the precise nutritional requirements for each sow at each stage or day of gestation," says Curtiss Littlejohn, Swine

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Products Manager at Canarm AgSystems.

The NRC model says there are several questions that should be asked to qualify what nutrition the sow needs during gestation, meaning that the one-ration-fits-all-sows way of feeding that most farmers have used is no longer optimal.

The pilot study with gilts showed little difference among precision-fed gilts and those fed one ration. There was little difference between the groups for lactation performance and piglet born alive weight. Feed intake was about 10 per cent better on the precision-fed gilts.

De Lange says that the performance of the herd based on precision feeding will be more accurate on a Phase two of the larger study now planned which will be able to look at environmental and economic impact.

"I believe there is a really bright future for precision feeding using electronic sow feeding systems," says de Lange.

For more information on Canarm's SowChoice Systems ESF, visit www.sowchoicesystems.com.

Brent DeVries joins Alliance Genetics Canada

Alliance Genetics Canada is pleased to announce that Brent DeVries has joined the team as

a customer sales and service representative.

Brent DeVries comes to Alliance Genetics Canada with a wealth of education and experience that will benefit the company's customers. He will help them to improve production, maximize the potential of their genetics and help in decision making by analyzing customer production data. He holds a Master of Science in Animal Breeding and Genetics as well as a Bachelor of Science in Agriculture with a major in Animal Science, both from the University of Guelph.

Brent most recently was a herd manager at a farrow to finish herd where he developed models to study factors affecting growth, and set up trials to evaluate nursery diets and feeding strategies. Brent has also worked for other swine genetics companies and as a breeding barn manager and farrowing technician.

Brent will call on Alliance Genetics Canada customers and support them with the products and services offered by the company. He also will analyze and collect data for studies and data management programs offered by Alliance Genetics Canada.

"Brent will be a tremendous asset to the Alliance Genetics Canada team. His research background and day-to-day pork breeding and production knowledge will make our customers more successful by helping them maximize profitability and the genetic potential of our genetics," says Dave Vandebroek, general manager of Alliance Genetics Canada.

Osborne introduces ACCU-TEAM™

Osborne Industries, Inc., a leader in the development of RFID (radio frequency identification)-driven swine management equipment debuted ACCU-TEAM™ at the World Pork Expo.

The ACCU-TEAM system is the first and only patented electronic sow feeding (ESF) system with integrated animal weighing technology. The system reliably captures individual body weights inside the feeding station to better target-feed sows and gilts throughout gestation. Producers and researchers have the ability to use the ACCU-TEAM system for dam selection for mature target weight in gilt development. Currently used to test differing feedstuffs and feed additives by specialized research facilities, ACCU-TEAM will be introduced to the industry at the World Pork Expo.

"ACCU-TEAM provides researchers and producers with an important tool that captures both feeding and weighing information simultaneously," said George Eakin, president and CEO of Osborne. "The weighing platform inside the ESF station completely eliminates the need for a secondary weighing station which increases investment costs and animal stress, and reduces free barn space."

The backbone of the new ACCU-TEAM system is Osborne's TEAM (Total Electronic Animal Management) ESF system. TEAM operates as a trusted and proven ESF (electronic sow feeding) system, developed through the collaboration of Osborne and various European companies



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in the 1980s. Osborne refined the system at their demonstration farm in the 1990s, and to this day, continues to supply its “rock solid” ESF system all over the world.

“Osborne was a key player in the development of ESF technology and has refined the management process since its inception over three decades ago,” said Brent Brown, engineering manager at Osborne. “ESF with TEAM is a tool that yields KPIs (key performance indicators) equal to or better than traditional stall systems, and ACCU-TEAM now allows for the collection of another important piece of information to allow producers and researchers to make more informed management decisions.”

For more information, visit www.osbornelivestockequipment.com.



Genesis announces new sales and technical rep

Genesis would like to announce Randy Schultz as sales and technical representative in Manitoba. Randy has been with Genesis for about a year and has been assistant general manager of Nucleus operations. In that role he has learned ex-

tensively about not only Genesis Nucleus, but multiplication and customer operations.

Randy was previously with Topigs-Norsvin where he was Production Manager for 12 years at their 750 sow Primary Nucleus Paradise Valley in Manitoba

In Topigs-Norsvin newsletter, we quote re. Paradise Valley

“Being the best genetic nucleus in the world doesn’t happen overnight, under the management of Randy Schultz (production manager) and assistance from Justin Reimer (genetics manager), the team effort of a diligent and capable staff at Paradise Valley has made all the difference in rising to the top.”

Randy has extensive knowledge in how Genesis performs compared to Topigs-Norsvin.

Randy has experience includes all aspects of nucleus and swine production. Randy will have responsibilities across all Manitoba. Randy is Manitoba born and raised and lives with his family in Steinbach.

Lee Container acquires Kane Manufacturing

Robert Varnedoe, president of Lee Container of Homerville, Georgia, is pleased to announce the acquisition of Kane Manufacturing, a producer of quality livestock and pet care products located in Pleasant Hill, Iowa.

CONTINUED ON PAGE 14

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Kane Manufacturing primarily serves customers in the pork industry. It began operation in 1969, manufacturing a grain scale. Since then, Kane's product line has grown to include a variety of heat mats for pigs, pets and reptiles, a full line of pig equipment from farrow to finish, all sizes of animal feeders and watering equipment, and animal sorting products. Kane serves customers in North America and markets around the world.

Kane Manufacturing will be owned by an affiliated company of Lee Container, and Mr. Varnedoe will serve as its president. Mike Kane, the company's founder, will remain as a consultant. The company will continue to operate under the name Kane

Manufacturing and to serve its customers from its present location in Pleasant Hill, Iowa with Kane's current, experienced staff.

"The acquisition of Kane Manufacturing represents a natural diversification of our product line," Robert Varnedoe said. "We use the same raw materials to make our products, and both companies have a long, successful history of serving the agricultural and pet care markets."

"I'm pleased that my company will be affiliated with a progressive organization like Lee Container," said Mike Kane. "Kane Manufacturing will be in good hands, and I'm happy to stay connected in a consulting role."

Lee Container manufactures high density polyethylene plastic containers for crop protection, lubricants, pet care, beverages, and industrial and household chemicals. The company began operation in 1989 and is headquartered in Homerville, Georgia. Lee also manufactures and distributes containers from facilities in Nacogdoches, Texas, and Centerville, Iowa. Additional information about the two companies is available at their websites www.leecontainer.com and www.kanemfg.com.

the controller to maintain desired room temperature.

Brian Rieck, AP product manager, said VariFlame connected to AP's EDGE™ controller also provides remote access, giving producers control of their heaters and many other inputs from a single system. "Producers can access diagnostics and adjust barn settings remotely from any web-enabled device," he said.

Other unique features of VariFlame connected to EDGE include:

- LED temperature probes, which provide flexibility to not only operate the heater, but also control curtains, fans and other equipment.
- Stir-fan mode, which allows producers to continue circulating air through the heater without turning on the burner as the animals grow and the heater is no longer needed. "This additional circulation of air is ideal for maintaining optimal and uniform environmental conditions," Rieck said. "It also provides an alternative use for the heater so it's not sitting idle during the warm months."
- Exercise mode, which allows EDGE to automatically turn on the heater at scheduled times to ensure it fires up correctly and remains in good working order.

Other features available on all VariFlame models support improved performance, durability and ease of use. For example, Rieck noted that most variable rate heaters range from 65,000 to 250,000 BTUs. "VariFlame has an extended range, from 55,000 to 250,000 BTUs, which not only allows the heater to run longer, but also provides improved heat distribution and humidity control," he said. "Even while operating at lower BTUs, the burner maintains consistent ignition reliability and flame stability."

He added that VariFlame is the industry's first all-stainless steel heater, making it the most durable and corrosion-resistant heater on the market. Easier maintenance is another benefit, since VariFlame is

AP introduces VariFlame™ variable rate heater for improved pork production management and the HI2LO™ Wet/Dry Feeder at 2016 World Pork Expo

AP (Automated Production Systems) launched three new products at the 2016 World Pork Expo offering exclusive advanced features for improved management of pork production environments.

VariFlame™ variable rate heater

VariFlame is the industry's first modulating heater that can work with any control system in the world. It seamlessly synchronizes and adjusts with the temperature curves set in



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See page 4

the first heater on the market featuring a single, easy-to-remove door that allows producers to easily access all serviceable parts from a single location. In addition, every aspect of the heater can be serviced using a single tool – a ¼ inch nut driver.

HI2LO™ Wet/Dry Feeder

AP's new HI2LO Wet/Dry Feeder is the only feeder on the market that has individualized trough space and nipples, allowing each hog to mix its optimal feed-to-water ratio. It is also the first feeder with double



adjustment capabilities, enabling producers to adjust the shelf height and feed gate as pigs grow

bigger. "HI2LO is the only wet/dry feeder tailored to serve the individual feeding preferences of your hogs," said Rieck.

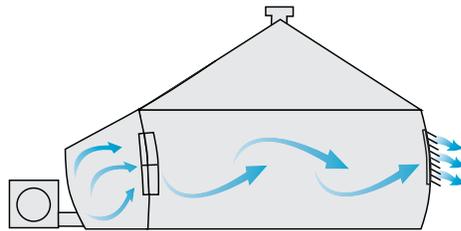
Other features include:

- Built-in weep holes for each individual trough space to eliminate flooding potential.
- "A" shaped shelf design and built-in agitator to help prevent feed clogging.
- Built-in hopper extension, allowing up to 450 pounds of feed capacity on the three hole feeder without paying for additional add-ons.
- Auto-flow control nipples to regulate water flow, regardless of barn water pressure.

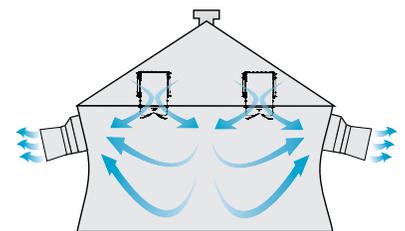
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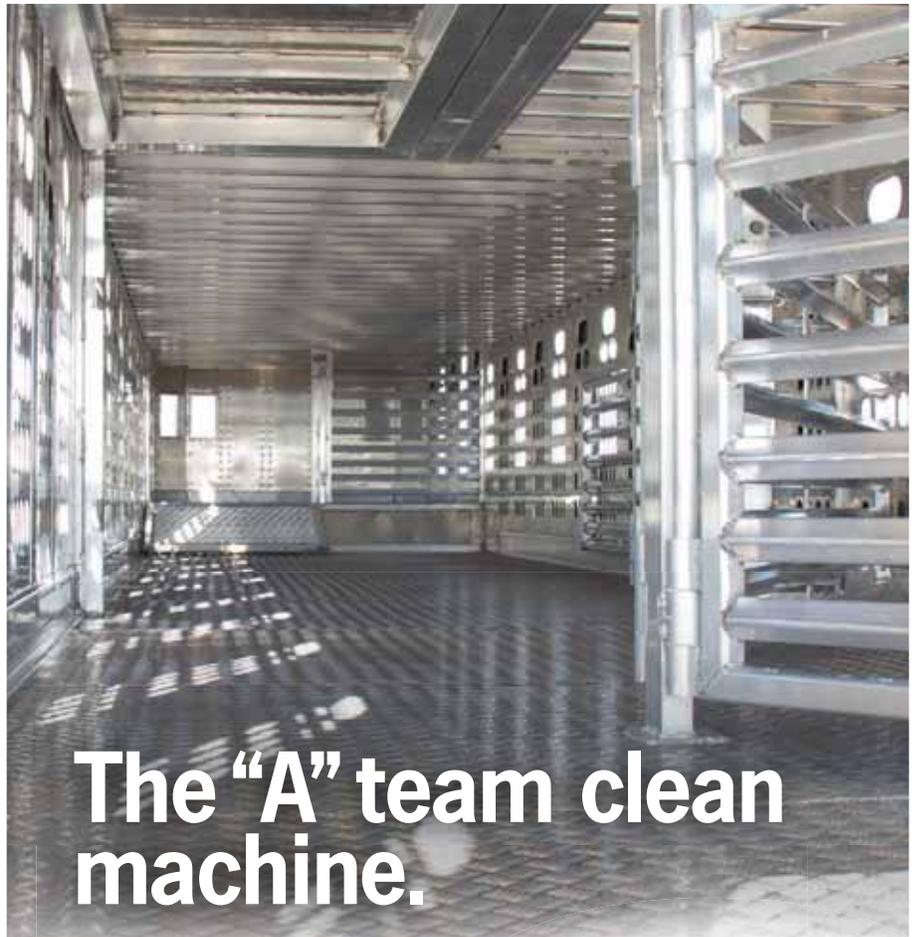
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FOR THE LOVE OF SCIENCE

Seeking the best flooring slat and gap widths for sow comfort and manure handling

By Christine Rawluk, National Centre for Livestock and the Environment, University of Manitoba



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It is well known both within and outside the pork sector that the industry is transitioning from individual stalls to group housing for sows. What is still

being determined are the most suitable barn designs, design features, and management systems for housing sows in groups. Unlike stall housing, there are a variety of options.

Animal welfare, profitability, productivity and functionality are key metrics in identifying the most promising barn designs. Barn staff and pig safety, health and well-being are paramount.

Scientific research is the primary tool for determining the pros and cons of a particular design feature or combination of features. It is also the means by which we can quantify the potential impact of a given design on all the key aspects of a sow operation such as those listed above.

A team of researchers with the National Centre for Livestock and the Environ-



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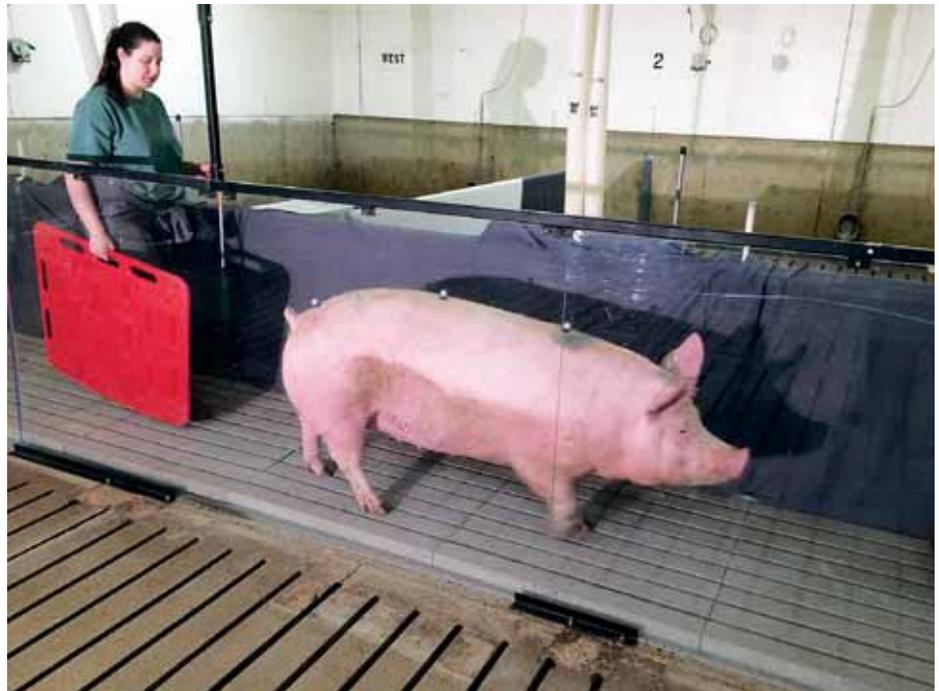
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ment at the University of Manitoba, working in collaboration with researchers across Canada and with Manitoba Pork, have developed and contributed to sow group housing decision making resources that have been shared widely with producers (Tools for Group Housing - <http://manitobapork.com/manitobas-pork-industry/animal-care/tools-for-group-housing/> and National Sow Housing Conversion Project - <http://groupsowhousing.com/>).

One current project is investigating flooring characteristics and social management for group-housed gestating sows. The project, funded by Swine Innovation Porc, involves researchers from the University of Manitoba, Prairie Swine Centre and AAFC-Sherbrooke. This research focuses on concrete slatted flooring configuration, pen environmental enrichment and sow mixing post-weaning in terms of productivity, profitability, functionality and sow well-being.

Drs. Laurie Connor, Qiang Zhang and Kris Dick at the University of Manitoba, along with ethologist Dr. Nicolas Devillers at AAFC-Sherbrooke, are looking specifically at the pen flooring design for group housing systems using concrete slatted floors. Taking a systems-based approach they are evaluating flooring based on both sow parameters and manure management implications.

“Concrete slatted flooring is the industry standard across North America,”



Technician Lindsey Lippens guides a sow along a corridor during the kinematics test.

says Connor. “Floors were designed for cleanliness and ease of in-barn manure management when sows were in stalls. Now that sows will be in groups, flooring design should also address sow comfort and mobility needs.”

Their study consists of two stages, one of which has been completed. First, a kinematics pre-test was conducted to identify the two most promising flooring designs for sow movement from a number of slat and gap width configurations. The second stage will evaluate the flooring at full-scale in pens with

sow groups over the course of two gestation periods.

Kinematics is a biomechanical assessment of motion. In this study kinematics was used to assess sow gait by analyzing digital recordings for sow walking speed, stride length, swing time, stance time and foot height for each limb, as well as joint angles during the walk along a specially constructed corridor.

Stage 1 – Kinematics pre-test

Sow locomotion using kinematics was evaluated using a total of 18 floor de-

CONTINUED ON PAGE 18

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signs, featuring combinations of three concrete slat widths (85, 105 or 125mm, equivalent to 3, 4 or 5") and 3 gap widths (19, 22 or 25mm, equivalent to 3/4, 7/8 or 1"). Each test-flooring was installed along a corridor with the slats facing either parallel or perpendicular to the direction of sow travel. A solid concrete corridor was used as the control.

"There does not seem to be a recognized standard for concrete slatted flooring for sows, although currently in North America five inch slats and one inch gaps seem to be most common," notes Connor. "Our other test dimensions were selected based on European manufacturing standards, but there is very little scientific literature to support these, except with reference to manure removal or floor cleanliness. Yet, we know there can be sow problems associated with concrete flooring."

Sows were video recorded as they walked down the kinematics corridor and their

movements analysed with specialized software to identify changes in gait parameters with the various flooring configurations. Both small, non-lame sows and large, lame sows were used in the study to account for possible differences in foot size and stride length as well as initial sow comfort influences.

The orientation and sizing of the slats and gaps did affect sow gait. They determined that flooring design had a greater impact on the gait of small, non-lame sows and that the impact was more pronounced when the flooring was oriented parallel to the direction of travel. Gait was least altered with slat width of 105mm (4") and gap width of 19mm (3/4").

Stage 2 – In-barn scaling-up test

The scaled up in-barn testing will assess this best performing slat and gap width combination from the kinematic test and compare it with the current industry standard of 125mm:25mm (5":1"). The flooring is currently being installed in two pens at the University of Manitoba swine research facility.

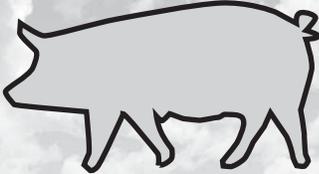
Starting as bred gilts, sows will be evaluated over two gestations for development of lameness, unevenness of weight distribution on each limb, general activity level, lying comfort and use of space within the pen. Manure handling measures will include pen cleanliness, percentage of manure coverage of the

floor, percentage of gaps blocked with manure, animal cleanliness, as well as air quality testing for ammonia and hydrogen sulfide levels.

These measurements will help the researchers determine if there are differences in how sows move and use the space within the pens, in the incidence and degree of lameness and injuries such as claw or hoof lesions over time and overall changes in how the sow carries herself and distributes her weight. They will also identify if there are differences in floor cleanliness and air quality between the two flooring systems, the importance of sow size and initial condition, as well as if indicators of sow comfort change over time.

The information from this study will be used to make recommendations and develop guidelines for designing and selecting slatted flooring for group sow housing which incorporates indices of sow well-being as well as ease of manure management

"Ultimately we want to be recommending a flooring system that promotes good sow health and comfort while maintaining the features for ease of manure removal. Reducing incidents of sow discomfort, lameness, injuries or infections translates to improved productivity, lower use of medications and lower rates of injury-related culling which all improve the bottom line," concludes Connor. ■



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Developing a tool for assessing airborne spread of animal diseases



By Dr. Qiang Zhang, Biosystems Engineering, University of Manitoba

There are three routes of animal disease transmission – direct contact between animals, indirect contact through contaminated objects, and airborne transmission. Most biosecurity measures for preventing animal disease spread have been focused on direct and indirect contact, with little consideration of airborne transmission.

Even for human disease transmission, which has been studied extensively, airborne transmission is still considered by many as an elusive pathway.

Airborne transmission may not be the main route of transmission for many animal diseases, but could be significant for some diseases, such as avian influenza. In contrast to disease transmission by direct or indirect contact, airborne transmission is less understood and much more difficult to control.

Even for human disease transmission, which has been studied extensively, airborne transmission is still considered by many as an elusive pathway.

A simple but critical question is; how far can disease pathogens travel in the atmosphere with wind? Answering this question requires a thorough understanding of several complex physical and biological processes associated with airborne disease transmission, including pathogen shedding by diseased animals; atmospheric dispersion of bioaerosols; pathogen survival (viability) in aerosols; and initiation of infection to naïve animals (Fig. 1).

Infected animals shed pathogens that are aerosolized and emitted to the atmosphere through ventilation (exhaust fans). Once aerosolized pathogens are emitted into the atmosphere, they will disperse in the atmosphere. Airborne transmission of pathogens is dictated by both the physical process of dispersion, as well as the biological rate of decay (survivability)

CONTINUED ON PAGE 20



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of pathogens. Once aerosols carrying viable pathogens reach the location of a naïve facility, the possibility for them to induce infection depends on whether aerosols can enter the naïve facility and the critical amount of aerosols inhaled by animals to cause infection.

A model for airborne disease outbreak assessment

Research has been conducted in different disciplines on various elements of the physical and biological processes associated with airborne disease transmission. Dr. Qiang Zhang’s research team attempts to integrate these physical and biological processes in a model for assessing airborne animal disease transmission in terms of the range of disease spread and the probability of surrounding naïve facilities being infected. This model will have four major components in it: 1) the quantification of pathogen and bioaerosol emission from infected animal facilities, 2) dispersion modeling of pathogen-laden aerosols in the atmosphere, 3) decay/survival of aerosolized pathogens during atmospheric dispersion, and 4) estimation of probability of causing infection in naïve facilities. The model will also consider the effect of aerosol type (liquid vs. solid) on airborne transmission of disease pathogens, as well as such environmental factors as humidity, temperature, and solar radiation (UV).

Once developed, this assessment model could be used as a tool for making control and eradication decisions in the event of an animal disease outbreak. This will benefit not only the livestock industry in Canada in terms of minimizing economic losses caused by animal diseases, but also the general public in terms of reducing the risk of zoonotic disease transmission. PRRS (porcine reproductive and respiratory syndrome), which is an important swine disease that costs \$130 million to the Canadian swine industry annually, will be studied as a model in Dr. Zhang’s research. This research program is funded by the Natural Science and Engineering Council of Canada (NSERC).

The research team

Carrying out this research requires expertise in the disciplines of engineering (physical and aerodynamic behavior of bioaerosols) and biological sciences (pathogen behavior). Dr. Zhang was trained as an agricultural engineer with expertise in animal production environment. His research deals with air quality issues in animal facilities, including odour, bioaerosols (dust), and ammonia. Dr. Zhang is collaborating with Dr. Kevin Coombs, Professor in Medical Microbiology, and Dr. David Levin, Professor in Biosystems Engineering at the University of Manitoba. Dr. Coombs research is focused on virus structure, function, assembly, and pathogenesis.

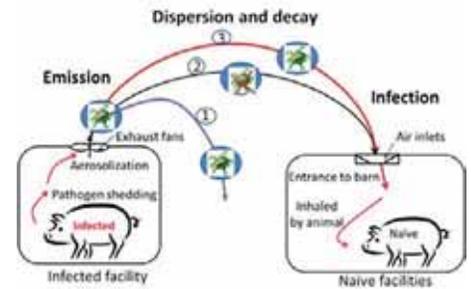


Fig. 1. Processes of airborne disease transmission. After pathogens are shed, aerosolized, and emitted to the atmosphere, there are three possible outcomes: (1) the aerosol settles out of the air before it reaches a naïve facility; (2) pathogens die during dispersion in the atmosphere; and (3) the aerosol reaches a naïve facility with viable pathogens in it. Only Outcome 3 can potentially result in disease transmission.

Dr. Levin’s expertise lies in molecular biology and genome sciences (genomics, proteomics, and bioinformatics). This team has a unique combination of expertise to tackle the complex problems associated with airborne transmission of animal diseases.

Dr. Zhang and his graduate students will conduct experiments in an aerosol chamber to study the behavior of pathogen-laden bioaerosols and develop the forecast model, while quantification of pathogens in terms of their concentration and survival/infectiousness in the air will be carried out in Drs. Coombs’s and Levin’s laboratories. ■

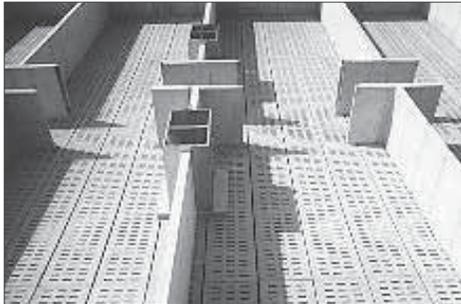


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Castration pain – measuring and managing

By Erin Davis, Prairie Swine Centre, and Shawna Ellis, Western College of Veterinary Medicine

For Erin Davis and Shawna Ellis, watching for signs of pain in newly-castrated piglets as they wander around their farrowing crate is a critical part of the students' research projects this summer.



Davis is a master's student based jointly at the Prairie Swine Centre and the Western College of Veterinary Medicine's Department of Large Animal Clinical Sciences while Ellis is a second-year veterinary student at the regional veterinary college. Under the supervision of swine ethologist Dr. Yolande Seddon, Davis and Ellis are working in collaboration with Jennifer Brown at the Prairie Swine Centre to investigate pain behaviour and pain management in piglets after castration.

Prey species – including pigs – do a good job of hiding their pain to avoid predators, so it's difficult to determine whether they're actually in pain, and what the severity may be.

The National Farm Animal Care Council (NFAACC) updated its *Code of Practice for the Care and Handling of Pigs* to include a new requirement stating that swine producers must give pain medication, in the form of analgesics, to help control post-procedure castration pain in piglets. This new ruling has led Seddon, Brown and their research students to take a closer look at how piglets show pain and the best ways to reduce that pain after castration.



Shawn Ellis (left) and Erin Davis.

Prey species –including pigs – do a good job of hiding their pain to avoid predators, so it's difficult to determine whether they're actually in pain, and what the severity may be. The main focus for Ellis, will be to investigate the subtle ways in which piglets show pain. In laboratory animals, the Grimace Scale measures changes in facial expression and is a method of observing animals in real-time to rapidly identify pain. Researchers have already developed grimace scales in mice,

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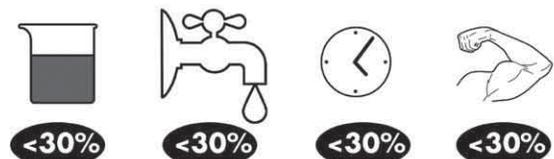
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rats, rabbits and horses, and some initial work has begun in pigs.

Ellis will look changes in piglet facial expression and also subtle changes in body posture, such as tail position and back posture, to identify pain behaviours in piglets. To achieve this, facial expression and body posture will be observed in two treatment groups: piglets castrated without pain control and piglets handled as if to castrate, but not castrated. Piglets will be observed immediately before and after the treatment procedure, with observations continuing thereafter up to 24 hours. Because behaviour is influenced by emotional state, it is hoped this method can separate out changes in piglet behaviour generated by handling stress, from those occurring as a result of pain. If successful, this work could contribute to the development of a piglet pain scale which would be a powerful research tool.

Davis will investigate methods to successfully apply the NFACC's new code of practice requirements for controlling castration pain in piglets and attempt to fill in several knowledge gaps. Lead by Dr. Jennifer Brown of the Prairie Swine Centre, this project is funded by the Saskatchewan Agriculture Development Fund includes collaboration from Drs. Yolande Seddon and Joseph Stookey at the WCVM, and Dr. Terri O'Sullivan at the University of Guelph. So far, producers haven't received much additional information about the types of pain medication suitable to use. There is also very limited knowledge on the best time to administer the medications to maximise pain control for the piglet. For example, is it better to provide pain control at the point of castration? Or to provide it at a set time before piglets are castrated? The Code of Practice requires that for castration performed after 10 days of age, piglets must be given anesthetic and analgesic to control post procedure pain. Therefore this project will also determine whether age influences piglet pain response and the effectiveness of analgesics to control pain in piglets up to 10 days of age. Oral sucrose is known to reduce pain responses in newborn infants, and initial work by the Prairie Swine Cen-

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tre has shown it may it may also reduce pain responses in piglets. Therefore, a final part of this project is to determine the value of oral sucrose solution to buffer immediate post castration pain before pain medication takes effect.

To help answer some of these questions, Davis will conduct a series of four experiments. In each study Davis will monitor piglets as they walk over small hurdles in a custom built handling chute before and after receiving pain medication. This simple behaviour test, developed through a collaboration between the Prairie Swine Centre and the WCVN, is able to identify piglets experiencing pain from those not, in the hour following castration. Findings will help to determine if the medications are successfully alleviating post castration pain

in piglets. Davis will also collect and analyze blood samples to measure cortisol as a physiological measure of stress, and additionally markers of pain and inflammation will be explored.

Results from these two research projects will help advance scientific understanding of piglet pain behaviours and provide robust information to producers on how to effectively control post-procedure castration pain in piglets, meeting the code of practice requirements.

Erin Davis' project is funded by the Saskatchewan Agriculture Development Fund and Shawna Ellis' project is funded by the Interprovincial Undergraduate Summer Student Research Award. ■

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Enrichment for sows

By Victoria Kyeiwaa, Prairie Swine Centre, SK



University of Saskatchewan masters student, Victoria Kyeiwaa, travelled halfway around the globe from her home in Ghana to look for ways to improve the management of sows in Canada. Working at the Prairie Swine Centre, her research focuses on enrichment measures for pigs, specifically in the area of sow enrichment.

While many different forms of enrichment materials have been studied, most of the research has been done on piglets and growing pigs. Examples are straw, chains, wood, rope, mushroom compost, wood shavings, garden hose, peat moss and rubber balls. These studies have shown that, when growing pigs are given appropriate enrichments, they can benefit from reduced aggression, fewer behavioural vices (such as tail-biting), reduced fear, and improved growth. While similar benefits can be expected for sows, older animals are different and generally prefer consumable enrichments over simple objects.

The farm-level interest in sow enrichment has been driven by the revised Code of Practice for the Care and Handling of Pigs, which includes a requirement that all pigs should be provided with “multiple forms of enrichment that aim to improve the welfare of the animals”. This code requirement and the increasing trend towards group gestation housing have created a need for research in this area.

Kyeiwaa’s research is part of a larger Swine Innovation Porc project, led by Dr. Laurie Connor at the University of Manitoba.

The research is being carried out at Prairie Swine Center and the University of Manitoba, and looks at different ways of developing effective environmental enrichment for group-housed sows which would be economically viable to the pig industry and could serve to guide producers in decision making.

European research has identified straw and other malleable and consumable materials as being optimal for pigs. However, in North America there is a greater reluctance to provide such materials. “Straw has been effective in grower-finisher pigs but there is an increased risk to biosecurity” says Dr. Jennifer Brown, Ethology Research Scientist at Prairie Swine Centre, and Kyeiwaa’s supervisor. “In this study, we included straw as a comparison treatment to the other enrichments,” explains Brown. Small amounts of high fibre materials (e.g., chopped or pelletized straw) can be provided, in a rack or hopper, for example, and will increase satiety (feeding satisfaction) in sows as well as providing enrichment.

Because pigs are social animals and their social status can influence enrichment use, the effects of social status will also be examined.

“Enrichment can help to reduce aggression and stress and improve physiological function for all ages of animals, so clearly there is a benefit to the industry, and providing enrichment will also help to address consumer concerns about barren conditions in pig housing.” adds Brown.

Sows in stalls show stereotypies or abnormal behaviours such

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small amounts of straw, wood on chains and a control treatment where there is no provision of enrichment materials. Because pigs are social animals and their social status can influence enrichment use, the effects of social status will also be examined. Social status is determined in a feed competition trial whereby six focal sows – three dominants and three subordinates – are selected for additional data collection. Mostly, in a social environment, subordinate animals are being bullied and driven away from available resources by dominant ones. Dominant and subordinate sows are selected in this study to determine if all sows,

irrespective of social status, will benefit from enrichment use.

as bar biting, continuous drinking and vacuum/sham chewing. Stereotypies are defined as behaviours with no clear function, and are seen as indicators of frustration, boredom, fear and stress.

A common problem with enrichments is that animals lose interest over time. Thus Kyeiwaa will also examine if regular rotation of enrichments can increase their interest and value to sows, compared to constant provision.

Sows in group housing also show some of these abnormal behaviours, especially ear/tail-biting, bar biting, as well as overt aggression, which can increase the chance of abortions. “Provision of environmental enrichment could potentially reduce or even eliminate these behaviours, but our question is, what types of enrichments do sows prefer?” asks Brown.

Cameras are mounted over the pens and time lapse photos taken on selected days to determine the level of enrichment use, and the activities and postures of sows. Stereotypic behaviours are recorded by live observation of sows, and levels of aggression are determined using skin lesion scores, ranging from 0 (no injury) to 3 (severe injury) on both sides of the body.

Four treatments are being provided to sows including; rope,

Accelerometers are used as automated measuring tools to record the mobility of animals, similar to pedometers used to record fitness activities in people. Accelerometers are being used in this research to compare the activity levels of dominant and subordinate sows. Saliva samples are also taken in early, mid- and end of each trial to determine cortisol levels as a measure of stress.

While the benefits of enrichment are well known, determining exactly what enrichments are suitable at each stage of production, as well as the best methods for presenting them, are still unclear. Kyeiwaa’s research will help to fill these gaps related to sows, and will form the basis for practical recommendations to benefit sows and help producers meet the code of practice requirement.

Enrichment is a new area for Canadian pig producers, and time is needed to clarify what is meant by enrichment and to implement these measures. “Once producers get comfortable with the concept of enrichment, I’m sure we will see them taking the lead on this and coming up with some great ideas,” Brown says.

This research project will be completed in December 2017, with results available in 2018. This project is funded by Swine Innovation Porc within the Swine Cluster 2: Driving Results Through Innovation research program. Funding is provided by Agriculture and Agri-Food Canada through the AgriInnovation Program, provincial producer organizations and industry partners. ■

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Answering livestock industry questions about manure management

By Darlene Meakin, Manitoba Livestock Manure Management Initiative

In 1998 the Manitoba Livestock Manure Management Initiative (MLMMI) was established as a means to addressing concerns about manure management in Manitoba. Over the course of the past 18 years, MLMMI has worked tirelessly in partnership with producers, industry, government and researchers to tackle the issues facing Manitoba's livestock industry and to come up with solutions to move the industry forward. The following questions and answers trace MLMMI's progress to date with a look to the future.

Q. How has MLMMI worked to address manure management issues?

A. Manitoba Livestock Manure Management Initiative (MLMMI) has played a vital role in coordinating research efforts to answer questions about manure management. Simply stated, we are focused on Manitoba's manure management priorities.

Our mission, "To foster sustainable development of the livestock industry in Manitoba in an environmentally sound and community-friendly manner," and our mandate, "To coordinate efforts to resolve issues relating to manure management, to assist industry in promoting sustainable management of manure as a valuable resource, and to encourage beneficial management practices, through research, development, demonstration and communication" clearly define our work.

Q. What are some of the keys to MLMMI's success over the past 18 years?

A. MLMMI has worked to specifically address the fact that Manitoba's livestock producers face a unique set of challenges. Manitoba's extreme climate, soil structures, prairie geography, surface water management and cropping practices have demanded locally developed information and solutions.

CONTINUED ON PAGE 28

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For that reason, MLMMI has zeroed in on these unique challenges. Another key to MLMMI's success has been bringing together a diverse membership drawn from volunteer representatives from all major livestock commodity groups, the public sector, environmental and consumer interests and academic and research institutions. This broad perspective helps keep MLMMI in touch with the dynamic and changing needs and challenges facing Manitoba's livestock industry. The combined expertise of science, business, engineering, public policy and industry knowledge is what has laid the foundation upon which MLMMI has been able to ascertain the best return on its investment in research.

Q. What have been MLMMI's priorities?

A. Among its many priorities, MLMMI has and continues to work on both nutrient concerns as well as issues related to pathogens, odour management, and barn worker health and safety in relation to manure management. Local conditions dictate local issues and questions concerning manure management, and while there are nuances in the soil types, crops grown and climate across the prairies, livestock producers throughout the prairie provinces share many common concerns.

Q. So what are the big questions facing Manitoba hog producers today when it comes to handling their manure?

A. While Manitoba livestock producers face a unique set of challenges, when you look even closer you realize that there are important differences within the province itself. In the livestock intensive southeast part of the province, soil test phosphorus (P) levels have increased as a result of a regional imbalance of land and livestock. In response, the province has introduced P thresholds that have changed the way these producers manage manure. The new P thresholds can severely restrict the amount of manure P that can be land applied, resulting in much larger land bases for manure application. Consequently, in order for livestock producers to comply, manure may have to be relocated significant distances to areas that require P.

Q. What about manure management in Manitoba should readers know?

A. Contrary to what many think, Manitoba does not have excess P. Rather, Manitoba has a P distribution problem (caused by too much P concentration in a specific area).

Q. What have been the goals behind MLMMI's research efforts?

A. Considerable effort and investment have been devoted to finding feasible, effective, economically viable and socially acceptable solutions to facilitate compliance with soil test P threshold regulations in southeast Manitoba. MLMMI has evaluated a number of alternatives, including five mechanical manure separation technologies (in order to minimize the quantity of manure to be relocated by the use of a centrifuge, press, incline screen, belt press, or reverse osmosis), passive separation (gravity) and manure transportation via pipeline or tankers.

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- Mechanical separation technologies are very expensive and entail significant operating costs;
- The use of passive separation by gravity is more cost effective but may not be effective enough in high density livestock areas;
- Transportation of manure using a permanent pipeline would require substantial capital investment and would likely precipitate social concerns; and
- Road transportation may precipitate social concerns about additional traffic, wear and tear on roads, and increased green house gas emissions.

Q. What are the guiding principles for the projects you invest in?

A. MLMMI works according to two key principles. The first is to focus on ideas and technology that are economically feasible, and the second is to focus on technologies or concepts that can effectively work under Manitoba conditions.

Q. Who does MLMMI’s research?

A. Expertise is drawn from Manitoba’s academic institutions and from research and development entities that specialize in the type of services that projects require. Indirectly, MLMMI is linked into other academic and related entities that are focused on similar issues in their jurisdictions. Sharing research and information provides an opportunity to learn from other experts without having to reinvent the wheel.

Q. Where is this research done?

A. The majority of research takes place in the field, in other words on farms or at test sites. The fieldwork is often followed up with laboratory testing and in-depth analysis. Manitoba producers can take pride in the calibre of agricultural researchers and developers we have in the province.

Q. What is MLMMI’s funding model?

A. Among MLMMI’s financial partners are Manitoba Pork Council and the Dairy Farmers of Manitoba given their in-

CONTINUED ON PAGE 30



Photos by Mitchell Timmerman

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terest in manure management. Every research dollar that is entrusted to MLMMI is invested 100 per cent on research, and is matched with government funds. Government funding, most recently through *Growing Forward 2 (GF2)* and previously through *Growing Forward (GF)* has offered significant support to the work that MLMMI does. *Growing Forward 2* is a federal-provincial-territorial initiative.

Q. What are some examples of projects MLMMI has supported?

A. Over the past 18 years, MLMMI has undertaken more than 70 projects.

Answers have been found to questions as diverse as, ‘What would it cost to build a pipeline in South East Manitoba to relocate manure?’ to ‘How long can the PED virus survive in an earthen manure storage in Manitoba’, to ‘Can we use gravity as a lower cost option in separating the phosphorus in liquid manure’?

The past year saw the conclusion of research, which began in 2014, to understand the survivability and infectivity of the PED virus under Manitoba conditions. Since the virus thrives under cold temperatures, MLMMI saw a need to understand how the virus would survive a Manitoba winter. Infected ma-

nure was collected at three PED positive sites and research revealed that the virus can survive and be infective for at least nine months in Manitoba’s earthen manure storages. This knowledge helps Manitoba hog producers perform their risk assessment of the PED virus. It also provides motivation for producers to remain vigilant in their bio-security practices.

Q. Is all of Manitoba created equal when it comes to manure management?

A. MLMMI has yet to find a solution for producers in the southeast that meets the criteria of being feasible, effective, economically viable and socially acceptable.

That said, it is important to keep in mind that overall, Manitoba has a P deficit, and imports significant quantities of P to meet the needs of local crops. In spite of all the work that has been done, new questions about manure management continue to emerge. A case in point is the recent interest in Manitoba about applying manure on tile-drained lands.

Q. What are some of the critical factors that come into play with respect to manure management?

A. Water management is a significant priority in Manitoba, and the risk of manure nutrients and pathogens transiting

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into watersheds has been identified as an area where more information would be helpful. Regional municipalities have questions about the environmental implications of nutrient/pathogen management on tile-drained lands. The best starting point to answer these questions is to consider the scientific evidence. MLMMI has researchers undertaking a literature review to summarize research done on nutrient and pathogen transport from tile-drained lands to waters. This will include a comparison of nutrient and pathogen transport from non-tiled and tiled land amended with manures starting with a good scientific review of what has been learned in other areas that may be relevant in Manitoba.

As with pretty much every agricultural activity, there are risks and there are practices to mitigate them. This work will also identify beneficial management practices (BMPs) that will decrease the risk of nutrient and pathogen transport to water via subsurface drainage systems under Manitoba conditions. MLMMI is also interested in understanding what gaps exist in the research conducted to date and recommendations on future research and development needs and priorities regarding the use of tile drainage in Manitoba.

Q. What is the value of MLMMI's work to producers?

A. MLMMI does the important groundwork to come up with solutions that individual producers either couldn't afford to do, or would find inordinately expensive. While no two farms are faced with exactly the same manure management issues, there are common threads that run from farm to farm. MLMMI undertakes scientific research and technology assessment, and also conducts on-farm research involving real-world commercial farm settings. MLMMI has recently undertaken more evaluation and demonstration projects broadening our research capabilities.

Q. What does the future hold?

A. Looking ahead, there will continue to be exciting opportunities to investigate manure management challenges and find the solutions to help support and strengthen Manitoba's livestock industry as we move forward. "Science has an important role to play in informing our management practices as Manitoba's agriculture industry goes forward. MLMMI will continue to play an important role in bringing this information together for the use of all stakeholders."

Producers who are looking for answers to their manure management questions are invited to visit the MLMMI website at www.manure.mb.ca. ■



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Swine research partnership receives industry support

By Jeanette Stewart, Communications Coordinator at the Western College of Veterinary Medicine



The Prairie Swine Centre (PSC), in conjunction with the University of Saskatchewan (U of S), is working on securing \$1.25 million in funds to support a comprehensive swine welfare research initiative. The two groups have already secured \$800,000 in industry funding to support this position.



Yolande Seddon

Swine ethologist Yolande Seddon will lead the new research program. Seddon joined the U of S as a faculty member in the Western College of Veterinary Medicine's (WCV) Department of Large Animal Clinical Sciences on Jan. 1, 2016. Previously she spent four years as a research associate in swine ethology at the PSC, during which she built up a strong rapport with the Canadian swine industry.

"This partnership bolsters our capabilities in swine health and further enhances our ability to provide producers and others in the industry with relevant, applied research focusing on swine behaviour and animal welfare," said Douglas Freeman, WCV dean. "Having Dr. Seddon join the WCV's faculty also provides our students with more insight into swine behaviour, health and welfare, and the issues facing the industry."

In addition to the university's support of Seddon's position, swine producers and processors across Canada have pledged to contribute \$800,000 to the program over five years. The goal is to raise a total of \$1.25 million for the position. Seddon will apply for matching funds that will potentially double the funds available for research over the next five years.

"The responsibility for humane animal care resides with the entire pork sector from production through to processing," says Florian Possberg, chairman of Sask Pork.

He adds that Seddon's position will provide the swine industry with a central repository for the latest research and information on swine housing and animal husbandry practices.

"Dr. Seddon's work will also provide a direct benefit to our industry as we navigate evolving animal care codes, regulations and consumer expectations and assist our producers in the de-

CONTINUED ON PAGE 34

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cision-making process as they transition their farms to adapt while continuing a high level of animal care,” says Possberg.

The funding will allow the development of a comprehensive swine welfare program, creating at least two new research positions as well as a technician and graduate students based at the WCVM.

Led by Seddon, this team will build on the work that the PSC has been doing in the area of swine behaviour and welfare for 25 years. This position will allow the research team to develop a greater depth of knowledge by bringing applied and basic science together over a longer period of study. It will be complimentary to the applied studies that currently take place at the Prairie Swine Centre.

The non-profit research and technology corporation has expertise in animal behaviour, nutrition, engineering and production economics. Research conducted as part of the industry-supported initiative will assist in improving knowledge of production practices, transport and slaughter.

This unique partnership is the first time the entire “pork value chain” is being invited and encouraged to support industry research, says Lee Whittington, PSC president and CEO.

“This collaboration, combined with a knowledge transfer mandate, creates an effective platform for advancing the science and best practices required to serve a modern and progressive industry. Pork processors have indicated they want a ‘go to’ group with independent credibility to assist them in their continual pursuit of best practices,” says Whittington.

Supporters include pork producers in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Prince Edward Island and New Brunswick as well as five packer-processors including Olymel, Maple Leaf Foods, Sunterra, Conestoga and

Hylife. PSC and Seddon will continue fundraising efforts by reaching out to retailers and food service providers for additional funds.

Olymel has pledged \$15,000 per year over a five-year period. Olymel CEO Réjean Nadeau says the company’s support for the research comes from a desire to promote best practices throughout the pork industry.

“Because the research findings ... are focused on animal welfare regardless [of] what production systems are in use, they should benefit all stakeholders in the Canadian hog industry – producers, veterinarians, processors and distributors. Retailers and consumers should also benefit from the pooling of efforts by the industry and these researchers, as several groups have called for changes in production practices in recent years,” says Nadeau.

The development of advanced scientific research programs will better address the current challenges of hog production and animal welfare, and lead to improvements in the production sector’s sustainability, adds Nadeau. This collaborative initiative will also strengthen an industry that makes a significant contribution to economic development and innovation in Canada’s agri-food sector [through] job creation as well as [expanding] the reach of Canadian expertise and products worldwide.”

This sentiment is echoed by Ben Woolley, chairman of the Pork Value Chain Roundtable and vice president of Sunterra Farms Ltd.

“To continue promoting Canadian pork exports on which we rely very heavily, we need to be seen to be constantly working to make sure that we are using scientific methods to determine the most humane way to raise out animals,” says Woolley.

CONTINUED ON PAGE 36

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“This is especially true with the recently-agreed upon European Free Trade Agreement coming into effect. We want to make sure we can take advantage of markets like this, and we need to be able to prove to our trade partners that we raise pigs in the most humane way possible.”

Seddon’s new role will allow her and her team to target future challenges and help to elevate the welfare profile of the swine industry. She also looks forward to sharing knowledge with the industry.

“Consideration of welfare is a firm component of good stockmanship,” says Seddon, who was selected for the role after a global search. “I’m excited ... to help support industry on welfare topics and to assist individuals and companies ... as new management techniques and technologies evolve.”

Further funding will allow Seddon and her team to create larger, more in-depth studies targeting core questions about swine welfare that extend over multiple years. Seddon will continue to work with PSC scientists as well as developing collaborations with researchers in veterinary medicine, nutrition and engineering and barn design, across Canada and internationally.

Seddon’s interests include animal behaviour, the animal’s perception of its environment and their interaction with humans. Her research focuses on developing practical improvements for managing pigs to improve their welfare and productivity.

“For 25 years PSC has worked with and for pork producers using science and communication to speed the adoption of changing best practices that improve economic return and ensure long-term sustainability of the whole industry. The development of this position is a natural extension of the needs of the industry being addressed through a national, research based investment that will serve the whole pork value chain, as well as the Canadian public for years to come,” says Whittington.

Industry groups say they support Seddon’s appointment to this position.

“Both organizations I represent fully support the nomination of Yolande Seddon to the position. I believe that she will serve the industry well in this capacity,” says Woolley.

Possberg says Seddon’s commitment and passion for the care and welfare of pigs is evident in the research that she has already undertaken and published in the U.K. and Canada. The projects she has completed during her time with the PSC also provided her the opportunity to work with numerous commercial hog operations.

“We believe [this experience] offers her a valuable perspective on the complex issues [that] producers encounter [while] raising food animals in a consumer-driven world,” says Possberg. ■



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Improving biosecurity in swine transport

By Sarah Ethier, Prairie Swine Centre, SK



I was one of the many industry stakeholders who watched with bated breath as PEDv spread across the United States and Canada in the spring of 2014. Within months it became increasingly apparent that even when producers were implementing excellent on-farm biosecurity practices, there were still serious gaps allowing the disease to spread quickly across the country. It has been repeatedly shown that transportation is a major vector for disease transmission in swine, and improved sanitation is a key factor in reducing transmission. The need for better cleaning and sanitizing procedures, and development of easier to clean trailers for the swine industry became clear, both to reduce the spread of PEDv, and to control other potential disease risks.

A number of problems have been identified which hinder the efficient and thorough cleaning of trailers. These include the low number of transport units available, downtime required between loads, and limited trailer wash capacity. In addition, current trailer designs are difficult to clean, requiring the use of manual labor at a high cost, and potentially leading to problems with cleaning consistency. This article describes an ongoing research project, led by Terry Fonstad at the University of Saskatchewan's College of Engineering, in partnership with the Prairie Swine Centre, the Vaccine and Infectious Disease Organization (VIDO), and Prairie Agricultural Machinery Institute (PAMI), to address these problems.

The Prairie Swine Centre is involved in the initial stages of the project, with the goal of producing an inventory of the current trailer designs being used in Canada. The main trailer



Sarah Ethier, Prairie Swine Centre

types in use will be ranked based on their ease of cleaning as well as on their animal handling characteristics (e.g. ramps and ease of loading). Some potential modifications to aid in cleaning, or to improve the handling of animals during loading and unloading will then be identified.

Once the trailer inventory is complete, the University of Saskatchewan and PAMI will proceed with developing automated tools to improve the efficiency and effectiveness of cleaning. The goal of these tools will be to reduce the time and labor needed to clean trailers, while improving the effectiveness and consistency of cleaning. In the final stages of the project, new procedures for sanitizing trailers and assuring biosecurity will be developed.

CONTINUED ON PAGE 38

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Previous research has shown that double flat deck style trailers are better for hog transport in terms of animal handling and ease of cleaning. However the comparatively low number of pigs in western Canada and the need for versatility in transporting both pigs and cattle makes it difficult for transport companies to justify the purchase of dedicated hog trailers. Most companies exclusively use pot belly trailers, as these can be used for both pigs and cattle. When it comes to the types of pot belly trailers available, there are three main manufacturers – Wilson Trailer Company (Iowa), Eby Trailers (Pennsylvania) and Merritt Equipment Company (Colorado), and each trailer design has different strengths and weaknesses related to maintaining biosecurity and pig handling.

If hydraulics can stand up to the climate, these designs may prove to be the future of livestock transport as they combine improved animal wellbeing and handling efficiency with the versatility of being able to haul a range of livestock species.

Wilson trailers are probably the most common in western Canada, as they have worked with producers to manufacture trailers that meet Canadian specific requirements for load weights and ramp angles. Eby trailers are increasing in popularity because they are designed with pigs in mind, but are still versatile enough to meet the needs of cattle. Merritt has also proven to be a popular choice, but these trailers are declining in popularity in western Canada as they are less willing to work on adapting trailer designs to meet the needs of the Canadian transport industry.

The average trailer takes approximately 5.5 man-hours to clean, and usually consists of two employees working together to complete a full trailer wash and disinfection. The more material in a trailer the longer it takes to wash, which means a quad deck trailer can take up to 6.5 hours to complete, especially since the floor requires being removed completely in order to be adequately washed. A few companies have noted that the change in shape of crossbars implemented by Eby manufacturing group has also helped with cleaning, as fewer passes of a pressure washer are required to clean them (Figures 1 and 2). Tight spaces like in-between hinges and behind lights can cause issues while washing, as wet straw or manure can easily build up and get compacted. Simple design changes like capped end-plates (see Figure 3) can help to prevent this buildup.

Animal welfare is greatly influenced by the handler. Therefore it is of importance that all handlers have appropriate training. However, having a good trailer design can make moving pigs on and off trailers significantly easier. Long ramps with low slopes and avoiding any type of step up or down can help facilitate animal handling. It falls onto personal preference as to the length of the ramp used to move pigs up to the top deck. Some handlers prefer a long shallow slope, with the ramp reaching all the way to the back of the trailer, where others may prefer a steeper slope, with the ramp starting a few feet from the back of the trailer, which makes it easier to get behind the animals and move them up the ramp.

You can't talk livestock trailer design in 2016 without mentioning hydraulics. Between Luckhart Transport in Ontario supplying their own hydraulic deck designs and Pezzaioli trailers imported from Italy and Steve's Livestock Transport of Manitoba winning Banff Pork's F.X. Aherne award for their hydraulic lift deck livestock trailer, these trailers are making a name for themselves in the North American mar-



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ket. Hydraulic trailers have multiple straight decks, and no internal ramps. Once a deck is loaded, the entire deck is lifted into position, making loading and unloading easier for pigs and handlers. The result is improved animal handling at loading and during transport, with shorter loading times and reduced stress and injury for livestock. Many producers and transport companies especially in western Canada are concerned with how the trailers will hold up in the harsh Canadian winters, however only time will tell. If hydraulics can stand up to the climate, these designs may prove to be the future of livestock transport as they combine improved animal wellbeing and handling efficiency with the versatility of being able to haul a range of livestock species.

The trailer inventory is still in the data collection phase, we hope to have a complete list of trailers in the coming months, at which time we will look at current trailer designs and identify any promising retrofit opportunities with PAMI and the University of Saskatchewan. Combining improved trailer de-



Figure 1. Merrit back gate, showing standard square cross bars.



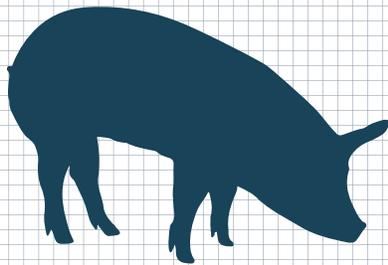
Figure 2. Eby back gate, showing slanted cross bars for greater ease of cleaning.



Figure 3. Many trailers put caps on exposed beams or rails to prevent buildup of bedding.

signs with automated cleaning will help to prevent the devastating spread of diseases such as PEDv, as well as helping to reduce the costs associated with transportation.

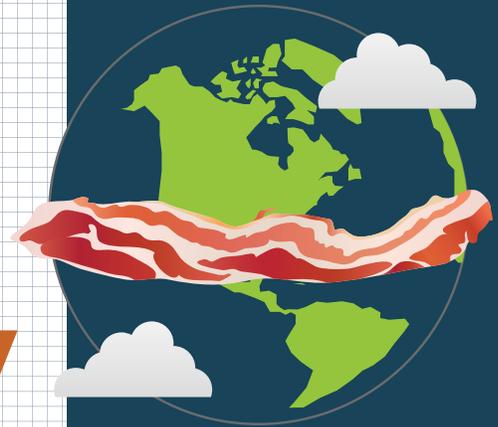
This project is funded by Swine Innovation Porc within the Swine Cluster 2: Driving Results Through Innovation research program. Funding is provided by Agriculture and Agri-Food Canada through the AgriInnovation Program, provincial producer organizations and industry partners. ■



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Meet Dr. Chengbo Yang, the newest animal scientist to join the University of Manitoba



Dr. Chengbo Yang is an assistant professor in Livestock Nutrition and Nutritional Biochemistry in the Department of Animal Science, University of Manitoba. Dr. Yang was born and grew up in a small town of Hunan province located in the south region of China. Hunan province is one of the major swine production provinces in China with a total production of 60 million pigs annually. In 1996, Dr. Yang was admitted to Nanjing Agricultural University in China to pursue his undergraduate degree and completed his B.Sc. in veterinary medicine in 2000. After graduation, he was accepted by the same university to pursue his post-graduate degree, obtaining his M.Sc. (2003) in veterinary medicine. He worked as a research assistant in the institute of Subtropical Agriculture, Chinese Academy of Sciences in China from 2003 to 2004, followed by a one-year Visiting Scholar appointment in the Department of Animal Science at the University of Guelph. Entering the Ph.D. program at Guelph in 2006, he obtained his Ph.D. in monogastric animal nutrition in 2011. He moved to China in October 2011 to work as RD/Technical Service Director in Lucta (Guangzhou) Flavours Co., Ltd. He was offered a job as a Technical Specialist of Swine and Poultry in a Canadian feed additive company Jefo Nutrition Inc and moved to Canada in 2014. In March

2016 he joined the Department of Animal Science at the University of Manitoba as an Assistant Professor.

Dr. Yang has a lot of experiences and connections in the feed industry. These experiences have generated great enthusiasm and passion in swine research. He is conducting research in the area of gut health and nutrient utilization relevant to non-ruminants and involved with teaching undergraduate courses related to livestock feeds and feeding. His research interests include 1) investigating molecular and cellular mechanisms of gut chemosensing in gut growth and health, 2) investigating roles of dietary components (feed ingredients and bioactive compounds) on modulation of molecular interactions between pathogens and host, 3) identification of antibiotic alternatives, and 4) biotechnological and nutritional strategies to improve nutrient utilization efficiency for sustainable animal production. He is currently working on characterizing bitter receptors and the spectrum of ligands in pigs. He is interested in the potential application of his findings from this research to mask bitter tastes from phenols, terpenes, glucosinolates and other bitter compounds that will improve the palatability of alternative feed ingredients in swine feed, eventually improve profitability of pork production.

Dr. Yang is a member of several professional societies, including Canadian Society of Animal Science, American Society of Animal Science, Canadian Society for Nutrition, American Society for Nutrition and World's Poultry Science Association. He has authored and coauthored over 30 scientific publications and has reviewed scientific articles for Canadian Journal of Animal Science, Comparative Biochemistry and Physiology, Animal Nutrition and British Journal of Nutrition. He currently serves as an editorial board member for Animal Nutrition. ■

2016 he joined the Department of Animal Science at the University of Manitoba as an Assistant Professor.

Dr. Yang has a lot of experiences and connections in the feed industry. These experiences have generated great enthusiasm and passion in swine research. He is conducting research in the area of gut health and nutrient utilization relevant to non-ruminants and involved with teaching undergraduate courses related to livestock feeds and feeding. His research interests include 1) investigating molecular and cellular mechanisms of gut chemosensing in gut growth and health, 2) investigating roles of dietary components (feed ingredients and bioactive compounds) on modulation of molecular interactions between pathogens and host, 3) identification of antibiotic alternatives, and 4) biotechnological and nutritional strategies to improve nutrient utilization efficiency for sustainable animal production. He is currently working on characterizing bitter receptors and the spectrum of ligands in pigs. He is interested in the potential application of his findings from this research to mask bitter tastes from phenols, terpenes, glucosinolates and other bitter compounds that will improve the palatability of alternative feed ingredients in swine feed, eventually improve profitability of pork production.

Dr. Yang is a member of several professional societies, including Canadian Society of Animal Science, American Society of Animal Science, Canadian Society for Nutrition, American Society for Nutrition and World's Poultry Science Association. He has authored and coauthored over 30 scientific publications and has reviewed scientific articles for Canadian Journal of Animal Science, Comparative Biochemistry and Physiology, Animal Nutrition and British Journal of Nutrition. He currently serves as an editorial board member for Animal Nutrition. ■



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The Monogastric Feed Research Group at Alberta Agriculture and Forestry

Who we are

We are a small group of researchers within the Livestock Research and Extension Branch of Alberta Agriculture and Forestry (AF) in Edmonton. The Monogastric Feed Research Group conducts research with both pigs and poultry. The Group consists of Eduardo Beltranena (lead) and Miranda Smit (technical writer/research assistant) on the pig side, and Matt Oryschak (research associate) and Zahra Dehghani (research assistant) on the poultry side.

Bio of Eduardo Beltranena



Eduardo Beltranena works for Alberta Agriculture and Forestry as Monogastric Feed Research Scientist, as part of the Livestock Research Sector. He was born and raised in Guatemala, then moved to Mexico to study Agricultural Engineering. He finished his B.Sc. degree in 1982, after which he joined ALDABI in Mexico for two years, where he managed a farm.

As part of this job, he conducted many field trials including early research feeding imported Canadian canola meal to broilers and pigs. He also developed key relationships with Alberta swine breeders and Canadian researchers. He then moved to Canada to pursue a PhD in swine nutrition and reproduction at the University of Alberta under supervision of Frank Aherne and George Foxcroft. He studied follicular hormonal feedback of the pituitary/hypothalamic function, which is to this date his favorite research project he has worked on. After finishing his PhD degree in 1992, Eduardo joined Calmar Feed Mill as nutritionist for two years. After that he moved to Kansas to start as postdoctoral fellow at Kansas State University. Within a year, he secured a position as researcher at the Prairie Swine Centre in Saskatoon, where he spent 10 years (1994-2004). In 2004,

Eduardo accepted a position at Alberta Agriculture, where he is currently still working as the principal investigator of the Monogastric Feed Research Group.

In his current position, Eduardo manages many research trials feeding co-products and/or underutilized ingredients to nursery pigs, grow-finish pigs, laying hens and broilers. He is still deeply involved in canola research. His areas of greatest interest include barn space utilization, dietary energy, feed as it affects carcass and pork quality, and enrichment of meat and eggs with omega-3s from camelina. This is reflected in the projects that he is currently involved in; 1) feeding of oilseed cakes to increase dietary energy, and 2) the interaction of dietary energy, crowding, feeder space and gender on growth performance, carcass and pork quality. Most recently, he has been reading a lot on reducing carbon and nitrogenous emissions to reduce the footprint of animal agriculture.



Eduardo's favorite part of the job is troubleshooting and modeling poultry and pig operations (barns and feed mills) to maximize their profitability, and he is inspired by the resilience and ingenuity of western swine producers who readily compete in a global market economy. If he could change one thing in the pork industry, it would be the funding and financing situation – too many resources are wasted begging for funding to conduct swine research. Moreover, bank financing limits industry expansion, which, if better backed up by government, could avidly increase exports to diversity GDP.

Eduardo considers some of his teachers his greatest mentors: Enrique Hernandez (Mexico), Alfredo Newell (Mexico), Frank

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Aherne (Alberta), and George Foxcroft (Alberta). His career highlight was moving to seek new opportunities. He was able to recognize when it was time to move on. Every move brought great rewards later on. His advice for new researchers: “Developing and maintaining relations with industry is as important as seeking innovation!”

Eduardo’s interests outside of work include renovating old houses, long distance running and cross-country skiing. He is also a private pilot with multiple ratings, and is always seeking to embrace new technologies (solar panels, fuel cells, H2 etc.).

Bio of Miranda Smit

Miranda Smit is technical writer/research assistant at Alberta Agriculture and Forestry and works in the Livestock Research Sector for the Monogastric Feed Research Group. She was born and raised in the Netherlands, where she studied Animal Science (B.Sc. and M.Sc.) at the Wageningen University. She also spent a year in France, where she obtained a second M.Sc. degree in Agriculture.



Miranda’s story of how she ended up in Canada and in the pork industry are connected to each other. While working on her Masters degree in The Netherlands, she asked her supervisor to find an exchange student opportunity for her in Canada, as she had been interested in Canada since she was a kid. Her supervisor, being a pig researcher himself, got her in touch with Egbert Knol from the Institute for Pig Genetics (IPG) and George Foxcroft at the University of Alberta and in 2006 she spent four months in Edmonton studying fetal programming in a dataset provided by IPG. After finishing her Masters degree, she returned in 2007 to the U of A to work as research technician at the Swine Research and Technology Centre (SRTC) for five months. This is when Miranda fell in love with pigs and Canada. She returned in 2008 to start her PhD in pig reproduction at the U of A under supervision of George Foxcroft. Her thesis ‘Litter birth weight and maternal n-3 LCPUFA supplementation in pigs’ looked at two things; 1). Effects of feeding marine oil rich in omega-3 fatty acids to sows on reproductive performance and offspring growth and health. 2) Effects of low litter birth weight as measure of prenatal programming on postnatal growth performance (how things in the uterus impact growth after birth). After 4.5 years, she defended her thesis in March 2013 and shortly after managed to secure a job at Alberta Agriculture under supervision of Eduardo Beltranena. She is currently still enjoying her work there.

In the past three years, Miranda has published magazine and journal papers relating to feeding canola meal and low-oil corn DDGS to grow-finish pigs. Currently, a paper is under review to be published in Canadian Journal of Animal Science titled ‘Feeding diets with reduced, constant net energy to growing-finishing barrows and gilts’. Miranda was also largely involved in two research trials feeding camelina cake to nursery and

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grow-finish pigs that took place at the SRTC in the past two years. She is currently working on writing up the papers for these projects. Miranda is most proud of the Livestock Research website that she has developed with help from others. It launched in March 2015 and gives a great overview of each research group's research goals, presentations, posters, factsheets, publications etc. It can be found at www.agriculture.alberta.ca/livestockresearch.

In her off-time, Miranda enjoys hiking/backpacking in the mountains, training horses, several kinds of dancing (Argentine tango, salsa, ballroom), traveling near and far, and learning new languages (currently working on Spanish).

What we do

We conduct applied monogastric feed research mostly involving nursery and growing-finishing pigs. Our activities focus on three objectives:

1. Increase utilization of novel and under-used cereal grains, legumes, oilseeds, their fractions and bio-industrial co-products.
2. Implement processing methods that improve feeding value and reduce the effects of anti-nutritional factors in feedstuffs.
3. Reduce the adverse effects of feedstuffs and co-products on growth performance, dressing, carcass characteristics, and pork quality.

'Fractions' mostly include starch, protein and fibre, which are the main components of cereals, legumes and oilseeds. For example, from canola meal we produce low- and high-fibre fractions; the low-fibre fraction is targeted to feeding nursery pigs whereas the high-fibre fraction is targeted to feeding sows.

'Co-products' are what's left from large-scale bio-industrial or human food processing. Co-products are not useless by-products to trash, but instead have economic value. For example, the main co-product of crushing canola seed for human food oil consumption is canola meal. The main co-product of fermenting wheat grain to produce ethanol for gasoline in-

clusion is wheat distiller's grains and solubles (DDGS). Both of these co-products are high in protein and phosphorus that pigs can readily convert into pork.

Our low-cost processing methods aim to increase digestibility and absorption of nutrients from individual feedstuffs. We utilize processing also to reduce the effects of naturally-occurring compounds in feedstuffs that interfere with the digestion and absorption of nutrients, like glucosinolates, phytate, trypsin inhibitors, insoluble fibre, etc.

Feeding bio-industrial or food industry co-products and even some grains reduce the feed intake of pigs, decreasing their weight gain, and the efficiency in which pigs convert feed into pork. Yet feeding co-products can be very cost-effective. Our research thus targets establishing both maximum and optimum feed inclusions of these feedstuffs and issuing recommendations to maximize profit margin after feed cost.

Feeding certain feedstuffs for example enhances fat colour whereas feeding others reduce pork firmness. We identify opportunities to enhance pork attributes and address threats to pork quality that result from high feed inclusions or prolonged feeding of feedstuffs that are cost effective. We therefore find the best compromise between pork quality and profitability for both producers and packers.

The graphical overview of AF's pork program shows examples of feedstuffs and variables we consider in our research.

Why we do it

- Feed represents 65 – 75 per cent of the cost of pork production. Reducing feed cost is central to all our research projects. It is the main determinant of profit margin for pig producers.
- Research into the feeding value of locally-grown pulses allows western Canadian pork producers to reduce their reliance on imported ingredients like soybean meal. This effort increases market demand for rotational crops (e.g., field pea, faba bean) and assures that lentil, chickpea, field pea that do



not meet export grade (e.g. splits) are utilized for feeding.

- Canada exports 2 out of 3 pigs either as pork or as live animals. Thus, our carcass traits and pork quality research is critical to assuring quality attributes to preserve consumer confidence and expand Canada's pork export markets.
- Expanded production of ethanol and bio-diesel in Western Canada generates large quantities of distillers dried grains and solubles and canola cake. Feeding these not only highlights the pig as convertor of bio-industrial co-products into pork, but also creates

local markets to sell the co-products to, which reduces distribution costs.

- Our research into the feeding value of fractions and co-products permits a single crop to be utilized for human food, bio-industrial applications and animal feed, thereby creating opportunities to add value to raw, undifferentiated agricultural commodities.
- Our research focuses on how to get more out of feedstuffs by increasing digestibility and thus largely reducing nutrient excretion in manure. Domestic and foreign pork consumers must have confidence that Alberta is an environmental steward and leader in farm animal food products. Our research directly benefits pork producers and packers, and indirectly benefits crop growers, bio-processors, rural economic development, and entices exports. We thus facilitate the growth of rural Alberta

communities, enabling producers, processors, and agri-businesses to succeed and be self-reliant in a highly competitive global economy.

Description of previous, current and future projects

At any point in time, we have several research projects going on, in different stages of completion. We will give a short overview of current and planned research trials, followed by a look at results from research we've done in the past two years feeding camelina cake to hogs.

- **Canola meal vs. soy expeller at two dietary energy levels**

In collaboration with Gowans Feed Consulting, we run commercial scale field trials. We are currently feeding either canola meal or soy expeller at two different dietary net energy levels to grow-finish hogs. We have previously shown that feeding low energy diets (2.1 vs 2.4 Mcal) is possible and

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even beneficial for the bottom line, but diets did not include canola meal or soy expeller. Both feedstuffs are locally (within Canada) produced and provide opportunities to either reduce or increase dietary energy level at low cost. We also need to confirm the response of hogs to low and high dietary net energy levels to endorse our previous feeding recommendations.

• **Effects of crowding, feeder space, dietary net energy level and gender on grow-finish pig performance and carcass traits**

In the fall of 2016, we will start a trial looking at the interactions between crowding, feeder space and dietary net energy level in grow-finish barrows and gilts. Hogs that are crowded don't grow as well as pigs that have space, but is this due to less feeder space per pig, or are other factors involved? Hogs fed lower net energy diets eat more to keep their caloric intake up, but is this still feasible in a more crowded environment? Do barrows and gilts react differently to changes in crowding, feeder space and dietary net energy value? These and other questions will be answered in this trial.

• **Feeding camelina cake to sows during gestation and lactation**

Previous research in our group has looked at feeding camelina cake to grow-finish pigs (see more information be-

low). Camelina cake does not seem to be toxic when fed to pigs. As the oil in camelina cake is high in omega-3 fatty acids, it could potentially be fed to sows to boost their piglets' health status. We have applied for funding for a research trial where we will feed different levels of camelina cake to sows to find maximum and optimum inclusion levels, and to look at piglet growth, scour scores, mortality and other parameters.

What two trials feeding camelina cake to nursery and grow-finish hogs has taught us

Before talking about our results feeding camelina cake to pigs, let's first answer the question why we care about this feedstuff in the first place. Camelina sativa, also known as false flax or gold-of-pleasure, is an oilseed crop (~42% oil) related to canola. Camelina possesses oil rich in poly-unsaturated fatty acids which makes it particularly well suited for biofuel for jet planes, cosmetics and human nutrition. Therefore, there is renewed interest in growing camelina in Europe, North America and Australia. Camelina also has favorable agronomic characteristics – it is early maturing, more resistant to diseases and drought than any of the canola species and the yield is competitive with that of canola. Camelina can be grown on marginal farmland, with relatively low inputs and no irrigation. Research has shown that camelina can be grown successfully in sev-

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eral different regions in Western Canada. The processing of the seed provides oil for biofuel production and a by-product in the form of camelina cake. In order to make industrial exploitation of camelina seeds for biofuel a reality, sustainable markets must be developed for the oil and cake before camelina will be accepted as a new oilseed crop.

Currently, camelina cake can only be fed to pigs up to 2% in the USA and is not allowed to be fed to livestock, except broilers (12%), in Canada. Before a novel feedstuff can be approved for feeding to livestock in Canada, the Canadian Food Inspection Agency (CFIA) requires the evaluation of data relating to feeding safety and efficacy. In order to get camelina cake listed in Schedule IV of the Canada Feeds Act, we performed two trials in nursery and grow-finish hogs. In the first trial, we studied the effects of increasing dietary inclusions of camelina cake in pig nursery (0, 6, 12, 18%) and grow-finish (0, 5, 10, 15%) diets on growth performance and indicators of toxicity. In the second trial, we fed 12% camelina cake to pigs in the nursery, and then looked at different withdrawal regimens in the grow-finish phase, feeding a control diet (0% camelina) starting in the finisher phase, developer phase or grower phase until slaughter.

In the first trial, feed intake (ADFI), daily weight gain (ADG) and feed efficiency (G:F) linearly decreased with increasing camelina cake inclusion (Figure 1). ADFI was 21% lower, ADG 32% lower and G:F 11% lower in hogs fed 18/15% camelina cake compared with controls. Increasing cake inclusion resulted in lower BW throughout the trial, linearly reduced ship weight, and increased days to slaughter weight. It took hogs fed 18/15% camelina cake 28 days longer to reach slaughter weight than controls (146 vs. 118 days, respectively). Increasing dietary camelina cake level linearly decreased carcass weight, dressing %, backfat depth and revenue per hog, linearly increased lean yield, but did not affect loin depth and index (Table 1).

Gross pathological exams of necropsied hogs did not show any abnormalities. However, liver weight linearly increased and spleen weight linearly decreased, both as % of BW, suggesting a greater metabolic burden in hogs fed high camelina cake levels. Heart, thyroid, kidney and pancreas weights were not affected by camelina cake levels in the diet.

Figure 1. Effect of increasing dietary camelina cake inclusion on overall growth performance in nursery and grow-finish hogs

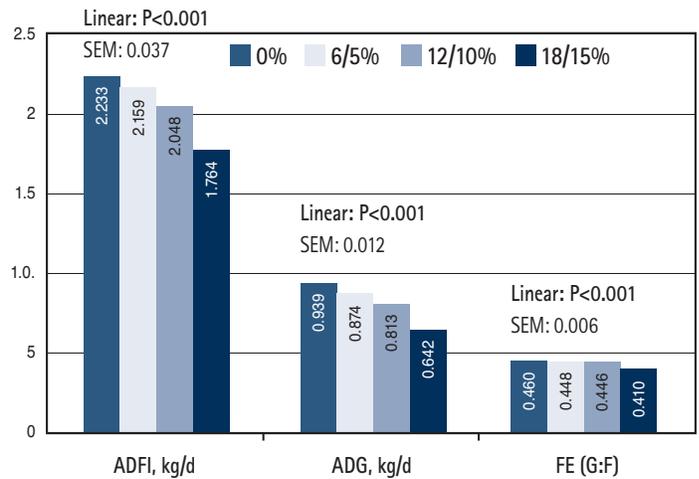


Table 1. Effect of dietary camelina cake on carcass traits

	0%	6/5%	12/10%	18/15%	SEM	Linear
Carcass weight, kg	99.8	96.1	93.8	95.7	0.8	<0.001
Dressing, %	79.7	78.6	78.3	78.3	0.6	<0.05
Backfat, mm	19.14	18.07	18.16	15.66	0.88	<0.01
Loin depth, mm	63.34	56.89	56.82	58.26	2.96	0.272
Lean yield, %	60.51	60.54	60.57	61.86	0.48	<0.05
Index	113.8	112.1	110.1	112.1	1.14	0.176
Calculated carcass revenue, \$	181.49	172.46	165.54	171.61	2.67	<0.05

We concluded from this first trial that feeding camelina cake to hogs up to 18% in nursery and 15% in grow-finish seemed

CONTINUED ON PAGE 48

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safe, but hogs did not like to eat it resulting in impaired growth rate and severe delays in pigs reaching market weight.

In the second trial, we studied the effect of feeding 12% camelina cake with different withdrawal regimens (no withdrawal [A], or withdrawal in the finisher phase [B], developer phase [C] or grower phase [D, Table 1]), in order to mitigate the detrimental effects of camelina cake on growth performance. Objectives of this research were to evaluate the effects of camelina cake withdrawal regimens on: growth performance, dressing, carcass characteristics, and safety indicators.

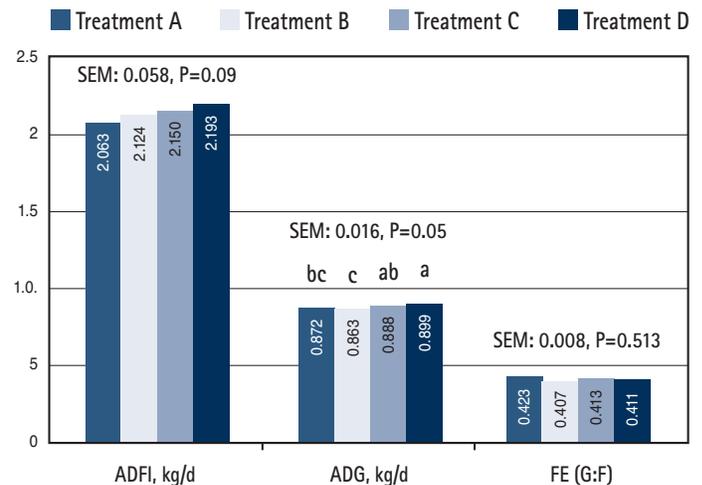
Overall (d0 – 3 weeks after start of finisher phase), feed intake (ADFI) tended to be lower (by 0.13 kg/d) for pigs fed camelina

Table 2. Overview of the four treatment groups of pigs (A, B, C, D) and which diet they were fed during each phase (containing either 0% or 12% camelina cake)

	A	B	C	D
Starter	12%	12%	12%	12%
Grower	12%	12%	12%	0%
Developer	12%	12%	0%	0%
Finisher	12%	0%	0%	0%

to slaughter (A) vs. pigs fed control diets from the grower period onwards (D). Daily gain was significantly lower for pigs on treatments A and B compared with D. Feed efficiency (G:F) was not affected by camelina withdrawal regimen (Figure 2). Days to shipping tended to be less for pigs on withdrawal regimen D (37.2 d) than B (43.0 d), but was not different from pigs on regimen A (38.7 d). Camelina withdrawal regimen did not affect ship BW, carcass weight, dressing, backfat, loin depth, lean yield, or index, but tended to have lower calculated carcass revenue for pigs on withdrawal regimen A (\$163.59) compared with D (\$172.98). At necropsy, no abnormalities were found in organ appearance or serum standard panel results. Liver weight was greater in pigs not withdrawn camelina (A; 23.4 g/kg BW) compared with pigs on withdrawal regimens B, C, or D (average 19.8 g/kg BW). None of the other organ weights were affected by camelina withdrawal regimen.

Figure 2. Effect of dietary camelina cake withdrawal regimen on overall growth performance in nursery and grow-finish hogs



In conclusion, as opposed to our previous trial, pigs fed camelina cake performed quite well, with only minor changes in ADFI and ADG. Withdrawing camelina at different phases did not affect carcass characteristics, or organ weights except liver. Together with the absence of abnormalities in organ appearance and serum samples, it can be concluded that feeding camelina cake to grow-finish hogs is safe and camelina cake withdrawal may not be needed to mitigate detrimental effects of feeding camelina cake. However, the performance of hogs fed camelina cake may strongly depend on the origin of the camelina seed. We used different seed for the first and second experiment; in the first trial hogs didn't like to eat the camelina cake, whereas in the second trial hogs had no problems with the taste. It is possible that seed in the first trial had more anti-nutritional factors that negatively affected the taste of the seed. We suggest to do more research on feeding camelina cake to grow-finish hogs and are currently trying to secure funding for this. ■

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Reducing temperature requirements for group-housed sows to reduce cost

By Ken Engele, Prairie Swine Centre



Work at Prairie Swine Centre indicates that sows in group housing systems will maintain room temperatures between 9 to 10°C, leading to approxi-

mately a 78 per cent reduction in energy consumption when compared to pre-set rooms (of 15°C).

Conversion of gestation sow housing from stalls to group systems has been mandated in the recently revised Canadian Code of Practice for the Care and Handling of Pigs, with all sow farms expected to adopt this practice by July 2024 (NFACC, 2014). As such, the pig industry is looking for management options that will take advantage of potential merits of group sow housing, in order to ensure successful implementation of group housing systems in all farms.

One such advantage of group housing systems is that sows can better interact with and control their immediate environment, including thermal conditions. According to Dr. Jennifer Brown “sows housed in groups have the freedom to exhibit thermoregulatory behaviour such as huddling to maintain comfort even when the temperature in the barn is lowered.” Temperatures currently maintained in barns when sows are housed in stalls are based on the reported lower critical temperature (LCT). Allowing the temperature to drop below this LCT will require additional feed to maintain the sow body condition and weight gain over the gestation period.

It has been estimated that sows housed in groups may have LCT values significantly lower than 15°C when given the ability to utilize behavior such as huddling. If group-housed sows

can maintain body condition and weight gain at temperatures lower than currently maintained in sow barns without the need for additional feed, “the potential exists to significantly reduce energy costs for heating and ventilation” notes Dr. Bernardo Predicala.

However, some issues anticipated with group-housed sows include the potential for higher activity levels and aggression among sows. These problems are exacerbated when sows are put on a restricted feeding regime, which is a common practice for gestating sows to maintain optimal body condition. The sensation of feeling “full” is improved with high-fiber diets; these diets are also known to reduce the urge to feed continuously, overall activity and repetitive behaviour in sows.

Dietary fiber increases heat production in sows without increasing digestible energy. As such, adding fiber to the diet can be a means of reducing activity and limiting aggression in sows under reduced barn temperature. According to Dr. Jennifer Brown “Addition of fiber to the diet could be a means of addressing behavioral issues associated with grouped-sows as well as contributing to the energy balance of sows under reduced barn temperature.” What temperatures do group-housed sows prefer? This is one of the questions the study set out to answer.

The project consisted of two phases, an environmental chamber followed by a group-housed gestation room. Results from the first phase of the study indicated that throughout the trial a pattern was observed where temperature changes occur mainly during the day when sows are mostly active, as barn operations were carried out (between 7 a.m. - 3 p.m.);

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beyond this period, lights in both chambers are turned off. Room temperatures at the time sows activated the operant mechanism was also recorded. Average temperature when the operant mechanism was activated was considerably lower at 10.5°C for the sows fed a high energy, low CP diet. This suggests these could tolerate lower temperatures before calling for supplemental heat compared to sows that were fed a low energy, high CP diet.

In terms of performance, sows fed with low energy, high CP diet seemed to have been more affected by the cold environment, resulting in a negative ADG of -0.5 kg/day on average over the trial period. While sows fed high a high energy, low CP diet in were able to tolerate lower temperatures and performed slightly better with average ADG of 0.2 kg/day.

The second phase of the project configured two barn rooms for group housing, with each room housing 28 gestating sows. One room was operated at a typical set-point temperature (16.5°C) while an operant mechanism was installed in the other room, allowing the sows to control the temperature. Similar to Phase 1, temperature fluctuations occurred mainly during the day (7AM-3PM) when sows are mostly active and when the actual switch presses occurred. Preliminary results for Phase 2 of the project, have shown that sows could tolerate temperature lower than the set-point typically maintained in gestation barns (i.e., 16.5°C) with sows maintaining temperatures about 5°C lower than in a pre-set room, leading to about 78 per cent reduction in energy consumption. At current energy prices, this 78 per cent reduction in energy consumption would improve the producers profitability by more than \$5/hog during the heating season. ■

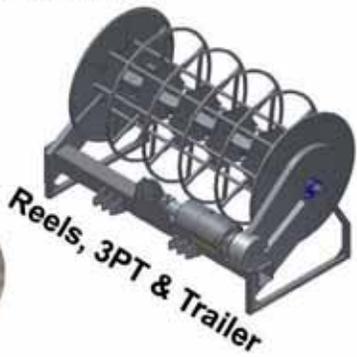


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Swine research, education and outreach at the University of Alberta in the Department of Agricultural, Food and Nutritional Science

By Ruurd Zijlstra

Researchers in the Department of Agricultural, Food and Nutritional Science (AFNS) enhance key value attributes for the pork industry and value chain. Research is focused on enhancing animal health and welfare, reproduction, pork quality, nutrient efficiency and reducing feed cost. The pig is also used as model for biomedical research. Professors together with their graduate students drive innovation using an array of facilities and collaborations and teach within two undergraduate student programs: Agriculture (Animal Science) and Animal Health. Together with an Advisory Committee, the Banff Pork Seminar is organized.

As the main animal facility, AFNS operates the Swine Research and Technology Centre on South Campus (SRTC) that is managed by Jay Willis. Professors collaborate with scientists from other organizations to provide access to SRTC or gain access to pigs elsewhere to reach better research outcomes and training opportunities. On North Campus, researchers use central laboratories for Genomics and Proteomics, Chromatography, and Proximate analyses. Under the umbrella of Livestock Gentec, genomics and associated research is organized.

The SRTC has a sow herd providing research animals and animal facilities for researchers in AFNS and biomedical researchers in other departments. Sows are housed in gestation and farrowing rooms. Weaned pigs are housed in nursery rooms until reaching 25 kg body weight, and some pigs can reach slaughter weight in a growout facility. Pigs can be surgically modified and housed individually in the metabolism wing of SRTC. The SRTC thereby supports teaching programs for undergraduate students, research programs for graduate students, and training in swine handling.

Livestock Gentec CEO Graham Plastow and researchers Leluo Guan and Paul Stothard apply genomic-based tools to support

the livestock industry. For porcine genomics, scientists study mechanisms in pigs that make them genetically less susceptible to disease, provide important new diagnostic tools for breeders, and expand our understanding of disease control mechanisms.

Swine health and immunity is studied by Dan Barreda and Richard Uwiera. Such research is tied to genomics as described above, to create robust pigs that rely less on antibiotics in research program led by Michael Dyck. Swine health is also tied to gut microbiology and produced metabolites in pigs by Ben Willing and Michael Gaenzle.

For biomedical research, the pig model is used by AFNS Human Nutrition professor Spencer Proctor who studies metabolic syndrome. Moreover, Pediatrics professor Justine Turner studies severe intestinal malfunction in young piglets.

Pork quality and animal welfare are becoming increasingly important for the pork industry. Pork quality is tied to important genomic, nutrition, husbandry and slaughter variables as studied by Heather Bruce. Animal welfare in particular related to group-housed pigs and automated behavior and welfare assessment technology platforms is studied by professor Clover Bench.

Finally, feedstuff evaluation research is conducted by Alberta Agriculture and Forestry Scientist Eduardo Beltranena and Ruurd Zijlstra. Such research includes new commodity ingredients but also novel feedstuffs that are created using dry or wet fractionation technologies at nearby Agri-Food Discovery Place on South Campus.

Strong ties exist among the researchers mentioned and their external collaborators, but the description above provides an entry to access scientists related to swine in our department. ■

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Denise Beaulieu, PhD, Assistant Professor Monogastric Nutrition, University of Saskatchewan



I am originally from Saskatchewan and received my undergraduate (BSA) and MSc degrees from the University of Saskatchewan. My PhD obtained from the Ohio State University was followed by further training at the University of Illinois. My research at this time primarily focused on the dairy cow and lipid metabolism in the rumen. I've had the opportunity to work with rats and mice, dairy and beef cattle, and sheep.

I was employed at the Prairie Swine Centre Inc., since 2001 and only recently transferred to the Department of Animal and Poultry Science at the University of Saskatchewan in March of 2016. My research program at PSCI has focused on

both animal and feed or ingredient factors which may impact the sustainability of pork production.

A major area of interest in our research program at the PSC has been the sow and the nursing and newly weaned piglet. We have been examining factors in the sow feed which may affect milk production and thus potentially growth rate of the nursing piglet. I have also conducted experiments which looked at the interaction between dietary factors and inflammatory response of the piglets, and diet/behaviour interactions. Another area of investigation I have been involved in is the increased utilization of by-product and low quality feeds, especially those available in Western Canada, for pork production. I currently have research projects examining the use of mycotoxin contaminated feeds, processing straw for use in diets of gestating sows and acid-preservation of high moisture grains. Results from these projects will enable producers to diversify their feeding options and produce high quality pork with feedstuffs that are not directly part of the human food chain. ■

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The importance of nitrogen for optimizing growth and efficiency

By Dan Columbus, Research Associate – Nutrition, Prairie Swine Centre



After energy, protein is the second most expensive nutrient in swine rations but utilization tends to be low. Retention of dietary nitrogen in pigs ranges from 30 per cent to

60 per cent of intake with much of this inefficiency the result of catabolism of excess amino acid/protein intake or unbalanced amino acid supply. This catabolism represents an energetic cost to the animal, reducing performance, and results in an increase in nitrogen excretion into the environment. Due in part to the contribution of dietary protein to total feed costs and the environmental impact of feeding excess protein, considerable research has been conducted to determine dietary requirements for essential amino acids.

While essential amino acid requirements are well defined, there has been a general lack of research into requirements for non-essential amino acids and total dietary nitrogen. With the increased availability of affordable crystalline amino acids, it has become possible to feed reduced protein diets while maintaining essential amino acid content and growth performance. Endogenous production of non-essential amino acids requires a source of nitrogen, therefore, in situations where total dietary nitrogen is limited, as could be the case in reduced protein diets with supplemental crystalline amino acids, essential amino acids will be used to meet requirements for non-essential amino acid production.

A concept familiar to ruminant nutritionists is the provision of sources of non-protein nitrogen (i.e., urea and ammonia) and

reliance on production of amino acids by rumen microbes. In addition to dietary supplementation with non-protein nitrogen, it has been well established in both non-ruminant and ruminant animals that a proportion of urea produced from amino acid catabolism enters the gastrointestinal tract where gut microbes are capable of utilizing the urea for amino acid production. This process, referred to as urea recycling, represents an important salvage mechanism to improve nitrogen retention during times of protein deficit, and presents an opportunity to both reduce feed costs and improve efficiency. However, the contribution of microbial amino acid production to meeting amino acid requirements in non-ruminants is not clear.

In order to more fully understand the utilization of non-protein nitrogen for lean gain in growing pigs a study was performed to determine the impact of infusion of urea or casein in the hindgut on whole-body nitrogen retention in growing pigs fed a valine-limiting diet (cornstarch-soybean meal based). Pigs were assigned to receive an infusion of saline, urea, or casein (40 per cent of dietary protein intake) into the cecum. It was hypothesized that nitrogen is absorbed from the hindgut as ammonia, which may contribute to the amino acid supply of the pig through urea recycling and microbial amino acid production in the small intestine. The majority of the infused nitrogen was absorbed and protein deposition (114, 128, and 130 g/d) was improved with infusion of both casein and urea, but did not differ between the two treatments. The efficiency of utilizing nitrogen absorbed from the hindgut was approximately 18 per cent. Therefore, while pigs can utilize non-protein nitrogen

CONTINUED ON PAGE 54

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to correct an essential amino acid deficiency, this is likely not efficient enough to be a viable dietary alternative.

In follow-up studies performed by Dr. Kees de Lange, University of Guelph, in which pigs were fed a diet limiting in non-essential amino acids, whole-body nitrogen retention (4.86, 6.40, and 7.75 g/d) and average daily gain (267, 314, and 360 g/d) were increased with the infusion of increasing amounts of urea into the hindgut. The efficiency of utilization of nitrogen in this study was nearly 100 per cent for both amounts of urea infused indicating that non-protein nitrogen absorbed from the hindgut can be used efficiently for body protein deposition under conditions of dietary non-essential amino acid deficiency. It was further demonstrated that similar average daily gain (399, 404, and 402 g/d) was achieved with the addition of ammonium citrate, glutamate, or a mix of non-essential amino acids to a diet deficient in non-essential amino, further indicating that pigs can utilize a source of non-protein nitrogen as efficiently as non-essential amino acids for growth when fed a diet deficient in total nitrogen.

Overall, these studies demonstrate that pigs are capable of utilizing non-protein nitrogen for body protein deposition and growth in diets limiting in either essential amino acids or total nitrogen. However, the results from these studies need to be interpreted with caution since conditions under which utilization were measured (for example, use of cornstarch based diets) do not replicate commercial practices. With increased use of alternative ingredients and co-products with potentially lower protein digestibility and continued use of crystalline amino acids in reduced-protein diets, it may become increasingly important to consider total dietary nitrogen supply.

Acknowledgements

Funding for this research was provided by Ontario Pork, Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA), the Natural Sciences and Engineering Research Council of Canada (NSERC), Swine Innovation Porc, and Evonik Industries AG. ■

Researcher profile - Daniel Columbus



Dr. Dan Columbus joined the Prairie Swine Centre as a research associate in nutrition in July 2015. Originally from Sarnia, Ontario, Dan completed his undergraduate degree from the University of Guelph in Animal Biology in 2004. Dan went on to complete his graduate training at Guelph under the mentorship of Dr. Kees de Lange.

His MSc research focused on the use of liquid feeding technology and phytase to improve availability of phosphorus in high-moisture corn based diets for newly weaned pigs. His doctoral studies, completed in 2012, examined the impact of dietary ingredients on availability of amino acids and nitrogen and the efficiency of utilization of non-protein nitrogen sources, such as ammonia and urea, for growth.

After completing his PhD, Dan moved to Houston, Texas where he completed his postdoctoral training under Dr. Teresa Davis at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine. Here, he applied his expertise in animal nutrition to investigate the nutrient and hormonal control of muscle growth and development with the overall goal of developing nutritional therapies for improving long term development and health of low birth weight infants, using the pig as a model species. His experience has given him an appreciation of the benefits of using the pig as a model for human health related research and how knowledge gained from research in the pig can have both agricultural and health science applications.



His current research interests include the impact of nutrition on pig health and robustness, the effect of early-life nutrition on long-term growth, and the evaluation of novel feed ingredients for use in the pig. ■

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Applied swine nutrition at the Prairie Swine Centre and the University of Saskatchewan

Submitted by Prairie Swine Centre



The swine nutrition program at the Prairie Swine Centre and the University of Saskatchewan is focused on providing pork producers with practical solutions to issues that may threaten the environmental, social, and economic sustainability of pork production in Canada. To accomplish this we work closely with the engineering and ethology groups at PSC, other researchers at the U of S, and institutions across Canada and the United States.

Prairie Swine Centre, Inc is a 300 sow farrow-to-finish swine facility. The nutrition research program studies swine at all stages of production. The goals of our research program can be summarized with the research objectives of the PSC. These include:

Objective one: To increase net income for pork producers through improved nutrition. This includes the development of feeding programs which emphasize economic efficiency, meat quality, and market value.

Objective two: Improve animal wellbeing by developing and modifying housing systems, animal management practices, and health of the pig.

Objective three: To reduce the environmental footprint of pork production through breakthroughs in the science of odour and gas emissions, nutrient and water management, utility and resource efficiency

Objective four: To address the needs of society by leveraging our knowledge of the pig. This includes for example, using the pig as a model for human health and nutrition.

PSC and the U of S work closely to achieve these goals. Dan Columbus leads

the research program at PSC while Denise Beaulieu recently joined the faculty at the U of S after more than a decade at PSC. Both teach at the University and supervise graduate and undergraduate research projects conducted at PSC. Students who undertake their graduate programs at PSC through the U of S gain exposure to the swine industry through the technology transfer program at PSC while meeting requirements for the MSc or PhD degrees, specializing in monogastric nutrition. ■



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Single kernel seed sorter (BoMill TriQ) and its potential effect on processing and in vitro digestibility

By Khalil Sahtout and Denise Beaulieu, University of Saskatchewan



BoMill TriQ is a seed sorter that uses near infrared transmittance (NIR) to sort individual kernels of wheat, barley or durum based on crude protein (CP). This could permit the production of grain samples with a more homogenous protein content, which is important for some milling or baking applications. Currently, nutrient values are based on sample averages, ignoring variability among kernels entering the feed.

The single kernel BoMill TriQ seed sorter is unique in that it has the capacity to be used in a commercial setting while other technologies can only be used in a laboratory setting. This technology is relatively new to the industry and it is

not known how fractions will react under different processing conditions.

A project therefore was conducted to assess the BoMill TriQ ability to sort individual kernels of wheat and barley into discreet fractions based on CP and whether these fractions require different processing. The first experiment determined if fractions obtained by using NIR seed sorting technology differed in kernel physical size or color. We found that the kernel fractions obtained did have different average color, but not physical characteristics. This lack of differences could indicate that processing, such as grinding, is not likely to be affected by the physical traits.

The second experiment used five sources of wheat and barley. Each of these source were fractionated by the BoMill TriQ so the following fractions can be used for grinding (unsorted, low crude protein and high crude protein). Each of the fractions were ground using either a hammer mill or a roller mill set to produce four different particle size. An in vitro digestibility system, designed to simulate digestion in the gastro-intestinal tract, was used to estimate if the rate of digestion of the fractions differed between grind-



ers and degree of grinding. Laboratory analysis of these samples is ongoing.

Acknowledgments

These experiments, supported by ACIDF (Alberta Crop Industry Development Fund) were conducted at the Canadian Feed Resource Centre in North Battleford, Sask., the University of Saskatchewan (U of S) and at the Prairie Swine Centre in Saskatoon. The data will be of interest to those involved in both the grain and livestock industries. The BoMill TriQ seed sorter was purchased by funding awarded to Dr. Tom Scott through the Saskatchewan Ministry of Agriculture, Agriculture Development Fund, Western Economic Diversification Canada, Alberta Crop Industry Development Fund and the Canadian International Grains Institute.

Biography

Khalil Sahtout is a student doing his PhD in the Department of Animal and Poultry Science at the U of S. He has a MSc from the U of S specializing in nutritional modeling. Currently doing his PhD in beef and swine feed processing. In his project he is currently also involved in grain cleaning and sorting, feed processing, and livestock nutrition.

His first BSc was obtained from Monash University with an honors degree specializing in the purification and isolation of antimicrobial work. His second BSc degree was obtained from the U of S specializing in animal nutrition. The MSc was obtained at the U of S specialization in animal nutrition. In his current role he works with species of livestock including beef, dairy, chicken and swine. His research objectives are to improve the consistency as well as quality of the various species grown in Western Canada. ■



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Atta Agyekum, MSc., Research Associate, Prairie Swine Centre



Atta Agyekum recently joined the Prairie Swine Centre (PSC) as a Research Associate in Nutrition. Atta was born and grew up in Kumasi, Ghana, a country in West Africa.

Atta's passion for research and keen interest in contributing toward ensuring food security (particularly animal protein needs) in his country led him to pursue a bachelor's degree in Agriculture with a major in Animal Science at the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana. Upon graduating in 2006, Atta was enrolled as a teaching and research assistant at the Department of Animal Science, KNUST, until he moved to Canada in 2009 to pursue his M.Sc. and Ph.D. degrees in Animal Science (Swine Nutrition) at the University of Manitoba (U of M), Winnipeg, Manitoba. His Ph.D. research at the U of M focused on using surgical pig models to elucidate exogenous enzymes effect on metabolic and physiological processes responsible for growth in growing pigs fed a fibre-

gestating sows, which will help improve satiety and ameliorate stereotypies associated with restricted feeding in gestating sows. Atta is also involved in nutrition research projects and participates in extension activities at the PSC. Atta's favourite research project was using the portal-vein catheterized pig model to study how exogenous enzymes supplementation impact nutrient and energy metabolism in growing pigs fed on fibre-rich diets.

Atta's greatest mentors thus far are his father and academic advisors, and what inspires him is knowing that what he does as a researcher contributes toward increasing knowl-

CONTINUED ON PAGE 58



rich diet. He expects to be awarded his PhD in July 2016. Atta also worked as a research assistant in swine nutrition and management at the U of M for seven years conducting experiments with various pig models, analyzing research data, and writing scientific reports and manuscripts for publication. At the PSC, Atta's research will focus on developing low-cost feeding strategies for group-housed

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edge on pig nutrition and management. In his spare time, Atta enjoys playing sports like soccer and also reads any article he can get his hands on. He also uses his spare time to participate in church activities. Atta is a member of the American society of Animal Science (ASAS).

Research

Developing low-cost feeding strategies for group-housed gestation sows.

During gestation, sows are limit-fed to prevent excessive body weight gain, however this practice may lead to aggression and stereotypies, of specific concern in group-housed sows. There is interest therefore in developing feeding strategies that will limit the negative effects associated with restricted feeding during gestation. Information available in the scientific literature suggests that offering sows bulky or fibre-rich diets during gestation can ameliorate hunger sensation and thus overcome behavioural problems associated with restricted feeding. Further, it has been reported that feeding gestating sows fibre-rich diets may result in an increase in litter size and performance.

Dietary fibre can be broadly classified as soluble and insoluble fibre based on solubility in water or weak alkali. Soluble fibre is more rapidly fermented by micro-organisms in the gut of the pig than insoluble fibre and previous reports suggest that

soluble fibre has a greater effect on satiety in gestating sows compared with insoluble fibre. However, most of the fibre-rich ingredients available for use in gestating sow diets are high in insoluble fibre. One approach that can be used to improve the solubility of feed ingredients that are rich in insoluble fibre is to employ feed processing techniques that will alter the physical properties, but not the total fibre content of such fibres.

The nutrition research group at the PSC are conducting studies to examine how dietary fibre inclusion and fibre processing methods affect metabolic responses and indices of satiety and behavioural measures in group-housed gestating sows and production parameters of their litter. Firstly, an in vitro pig fermentation model was used to determine methods to increase fibre solubility in processed wheat and oat straw. Group-housed gestating sows will then be fed diets differing in fibre type and processing method to determine the effect of dietary fibre inclusion and fibre on indices of satiety and performance of sows and the growth performance and carcass quality of their offspring. Sow behaviour will also be monitored in order to determine the incidence of sow aggression and stereotypic behaviours with increase dietary content of soluble fibre. The information generated from this research will lead to the development of low-cost feeding strategies for group-housed gestating sows. Specifically, this research will lead to recommendations for the use of processed fibre in gestating sow diets as a means to counteract the negative effects of restricted feeding on performance and behaviour.

Acknowledgements.

We acknowledge funding for this project from Swine Innovation Porc (SIP), Sask Pork, Manitoba Pork Council, Alberta Pork and Ontario Pork and MITACS. ■



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Particle size of grains and swine diets from on-farm mills in Western Canada and the cost of grinding wheat or barley using a hammer or a roller mill.

Danilo Sotto,^{1,2} Tom Scott¹ and Denise Beaulieu^{1,2}

¹University of Saskatchewan ²Prairie Swine Centre, Inc.



Particle size reduction improves feed efficiency in all stages of the production cycle in pigs. Based on studies by researchers at Kansas State University (KSU), an average particle size of 700 to 800 microns is recommended. However, this recommendation is based on studies conducted using corn-soybean meal based diets. To our knowledge, there is no information on the effect of particle size in wheat and barley-based diets from on-farm mills in Western Canada. This presents an opportunity to improve animal performance and income for producers by improving our understanding of particle size under regional conditions.

Feed and ground grain samples from one toll mill facility and four on-farm mills (two in Alberta and two in Saskatchewan)

were collected and analyzed for average particle size to establish the variability among mills. Except for one farm that uses a disk mill, all of the participants use a hammer mill. The average particle size in samples of wheat was 795 microns (697 to 889 microns) and barley was 833 microns (818 to 827 microns). On average, wheat was ground within standards set by the Kansas State University (700 to 800 microns using corn-soybean meal-based diets) while barley particle size was slightly coarser, but within acceptable variation limits (+10 per cent).

Particle size of complete feeds from two of the farms was higher than KSU recommendation indicating possible losses in terms of feed efficiency. The diet particle size ranged from 657 to 968 microns (832 microns on average). Variability in diet particle size was possibly due to the type of grain used,

CONTINUED ON PAGE 60



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Danilo Sotto

other ingredients used, and their proportion in the formulation. All farms were aware of the benefits of particle size reduction in improving feed efficiency; however none had a program in place to monitor particle size. The majority of the on-farm mills cite flowability as an issue when grinding grains (or diets) to a smaller particle size. However, our results suggest that bulk density, fat content and their interaction with particle size may also affect flowability. Regardless of particle size, wheat and wheat-based diets flowed better than barley and barley-based diets. The second project used five sources each of wheat and barley, ground to an average particle size of 550, 700 and 850 microns using either a hammer or a roller mill to determine the effect of grain, type of grinder, particle size and their interaction on grinding cost, particle and handling characteristics of the

ground grains. Using current power cost, grinding barley resulted in higher grinding cost compared to wheat (0.58 vs 0.36 \$/ton). Regardless of grain and particle size, grinding cost using the roller mill was lower than the hammer mill (0.27 vs 0.66 \$/ton). Reducing the particle size of wheat or barley by 300 microns regardless of grinder increased grinding cost by 41 per cent in barley and 38 per cent in wheat. Flowability was negatively affected when the particle size of either wheat or barley was reduced. Consistent with results from the first project, wheat flowed better than barley, regardless of particle size. We suspect that an optimum ratio of wheat and barley in a finely ground diet may address flowability issues.

Grinding barley from 850 to 550 microns using the hammer mill had the highest grinding cost (from \$0.64/tonne to \$1.05/tonne). Using this information and the feed efficiency improvement of 1.3 per cent for every 100 micron reduction in particle size, we estimate a net savings of \$7.8/pig due to reduction in total feed cost just by reducing particle size of barley by 300 microns.

Acknowledgment

Funding for this research project was provided by Alberta Crop Industry Development Ltd. (ACIDF).

Biography

Danilo Sotto, Jr. is a PhD student at the Prairie Swine Centre Inc. and University of Saskatchewan under the supervision of Dr. Denise Beaulieu. He obtained his B.Sc. and M.Sc. from the University of the Philippines Los Banos and has been working with the Philippine feed industry before coming to Saskatchewan in 2014. As an animal nutritionist, he is interested in finding ways to improve feeding value of ingredients through feed processing in order to improve animal performance and health, and reduce feed cost to improve profitability of pig production. His Ph. D. program is also supported by a study grant provided by industry partner Gowans Feed Consulting. ■

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Are the negative effects of the mycotoxin, deoxynivalenol (DON) due solely to effects on feed intake?

Vaishnavi Iyer Aka Aiyer,^{1,2}
 Dan Columbus² and Denise Beaulieu¹

¹University of Saskatchewan
²Prairie Swine Centre



Deoxynivalenol (DON), commonly known as vomitoxin, is a mycotoxin produced by the fungi *Fusarium graminearum*, which infects all grains, especially wheat and barley. Grains infected with fusarium are typically downgraded to be used as livestock feed. Pigs are highly susceptible to DON contamination, and show reduced feed intake and growth rates. In a previous study at the Prairie Swine Centre, we showed that feeding a diet containing 1.56 ppm DON to nursery pigs reduced ADFI by 5.6 per cent and ADG by 4.9 per cent. CFIA recommends swine diets not to exceed 1 ppm. The best strategy to deal with mycotoxins is to avoid feeding them to swine completely. However, with increased amounts of DON contaminated grain entering the livestock sector, this may not be possible and economical strategies are required to allow for safe feeding practices.

There have been many different strategies employed over the years to reduce the negative effects of feeding mycotoxin contaminated grain to swine, including the use of feed



Vaishnavi Iyer

additives such as binders. Certain mycotoxins such as aflatoxin respond well to the presence of binding agents in the diets; however, these agents do not appear to as effective with DON. In another study at the Prairie Swine Cen-

CONTINUED ON PAGE 62

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tre it was shown that the use of spray dried animal plasma mitigated the negative effects of feeding DON contaminated diets to nursery pigs. The current experiment explores this further. Specifically we want to determine if the negative effects of DON, and potential remediation by plasma can be explained by the effects on feed intake. We are conducting an experiment this summer (2016) with a group of pigs fed diets containing DON contaminated wheat with and without the addition of spray-dried bovine plasma. We will monitor feed intake carefully and another group of pigs will receive the same diets, but in amounts equal to the intake of those pigs in the first group. Therefore if some of the diets in the first group cause a reduction in feed intake, this intake will be matched by pigs in the second group. The results of this experiment will allow us to separate the feed intake effects of

DON from other potential physiological effects. This information will help us to design DON mitigation strategies.

Acknowledgements

This work is supported by the Agriculture Development Fund of Saskatchewan. We thank American Protein Company for an in-kind donation of the spray-dried animal plasma.

Biography

Vaishnavi Iyer came to Canada in 2014 to pursue her Bachelor's degree in Animal Bioscience at the University of Saskatchewan. She has currently finished her third year of study and will be entering her final year towards her Bachelor's degree. After graduating from high school in India she volunteered at a veterinary clinic. She always felt a connection towards animals and wanted to help and learn more about them.

The University of Saskatchewan and Prairie Swine Centre provided Vaish with an opportunity that is allowing her to work at the Prairie Swine Centre for her thesis project during the summer of 2016, supervised by Dr. Denise Beaulieu and Dr. Dan Columbus. She considers the best part of working in the Prairie Swine Center is the experience she will gain in all aspects of pork production. Working at the Swine Centre has allowed her to gain hands-on experience and develop confidence in the field. Last but not the least, having knowledgeable and helpful staff members made the learning process very effective and enjoyable at the same time for her.

The experience she will gain while working on her experiment at Prairie Swine Centre is very valuable for her research thesis as she is involved in all aspects of the experiment. This includes sample collection in the barn and analysis in the lab and then statistical analysis of the data. Vaish would eventually like to pursue her master's degree in veterinary pathology and learn more about the diseases caused in animals due to pathogens and to develop further understanding on how to cure those diseases. ■

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Bacterial fermentation of wheat and barley to improve feeding value

By Kylie Hutt, Denise Beaulieu and Andrew van Kessel, University of Saskatchewan



There is a growing interest in the development of low cost management and

feeding strategies for newly weaned pigs in order to improve gut health and performance parameters while acting as an alternative to antibiotics and high cost feed ingredients. Grains are the major ingredients in pig feeds and therefore they greatly influence the cost of pork production.

Wheat and barley are two of the major energy sources used in pork production within Western Canada. Today, because of extreme weather events occurring more often, the water content of grains often rises above 15 per cent when harvested. While there is the option of drying the grains post harvest, this strategy is costly. A possible low cost alternative for preserving high moisture grains would be ensiling these grains by adding bacterial inoculants and storing them under the correct conditions. While it is understood that ensiling

grains could be a cost effective alternative for farmers, more research is needed in terms of investigating how the nutritional value of the grain is affected and the effect of feeding these grains, especially to the newly weaned pig, has on gut health and performance parameters.

Weaning is a very challenging and stressful time for the piglets as they are abruptly transitioned from an all milk diet to a non-milk diet. Key limitations to efficient pig production include low voluntary feed intake followed by poor growth during the post-weaning period. Therefore, there is good evidence that diet formulation could influence gastrointestinal morphology, physiology and microbiology. Research in Europe has shown that feeding fermented liquid feeds to pigs improves performance and intestinal health. Although there has been some work examining the effect of ensiling high moisture maize and sorghum with lactic acid bacteria there is a limited amount of information regarding ensiling high moisture such as wheat and barley. The aim of this study is

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Kylie Hutt

to further investigate the effects of the addition of lactic acid bacteria ensiled wheat and barley into diets on intestinal barrier function and morphology, performance and digestibility in piglets

The experiment will be conducted during the summer of 2016 using grains which were ensiled in experimental barrels at the CFRC for several months. These will be fed to newly weaned pigs for the entire nursery period. We are interested in whether the fermented grains improve feed intake and growth of these piglets and if these results can be explained by changes in gut morphology or function. Although this experiment is designed for the pork producer who is looking for feed ingredients which maintain the health of newly weaned pigs, it will also be of interest to grain producers looking for alternatives at harvest.

Acknowledgements

This work is supported by Swine Innovation Porc (SIP) and Bunge Inc.



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Biography

Kylie Hutt is a summer student at the University of Saskatchewan. She has completed three years in the Animal Science Program at the University of Saskatchewan and is going into her fourth and final year of the program in the upcoming fall of 2016. She is currently working on her six-credit thesis research project at the Prairie Swine Centre. Kylie is originally from a beef cattle/grain farm near Tribune, Saskatchewan. She came to Saskatoon in 2013 to start working toward her dream of becoming a livestock veterinarian.

This research opportunity interested her because not only is she intensely interested in the physiology of the gastrointestinal tract and the impact nutrition has on the gastrointestinal tract and on the performance of livestock, but also because she wanted to gain experience in the swine sector and in conducting research. She finds it intriguing to be investigating an area that could have great benefits for livestock producers of the future. This is her first experience conducting research and she is loving every second of it so far. Her favourite part of her job is being out in the barn interacting with the piglets every day and also being apart of a great team of researchers and students that all come together to make experiments happen. Outside of work, Kylie is very interested in health and fitness and spends a large portion of her time motivating and inspiring others to live a healthier lifestyle.

One thing Kylie has learned since she began being apart of conducting research is that there are many different factors that weigh in on experimental protocols and therefore nothing is set in stone until the trial officially starts. There is always something new and exciting to be debated when it comes to planning an experiment and while it may seem a little bit stressful at times, it's all part of the journey and the fun! The advice she would give to future researchers is to find an area of research that they are extremely passionate about and everything else will fall into place from there. She also wants to remind future researchers to have a little fun along the way and to find time to be in the moment and realize that they are part of changing the future for the better. ■

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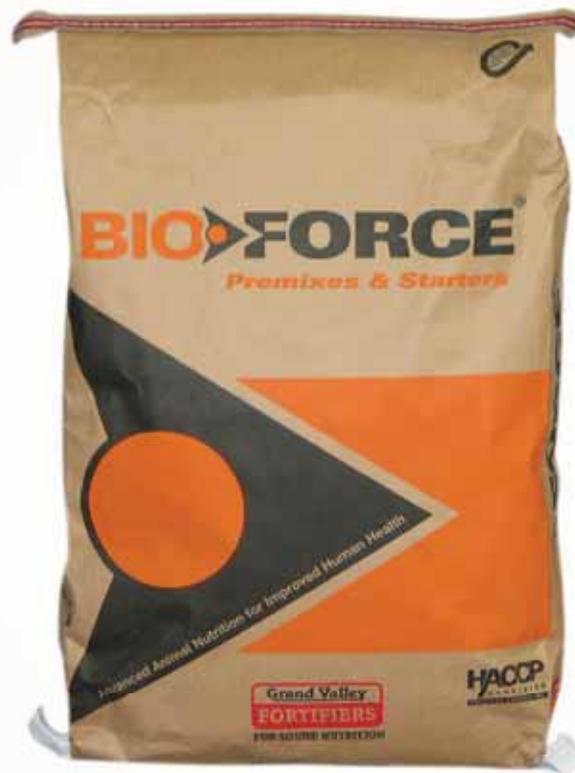
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