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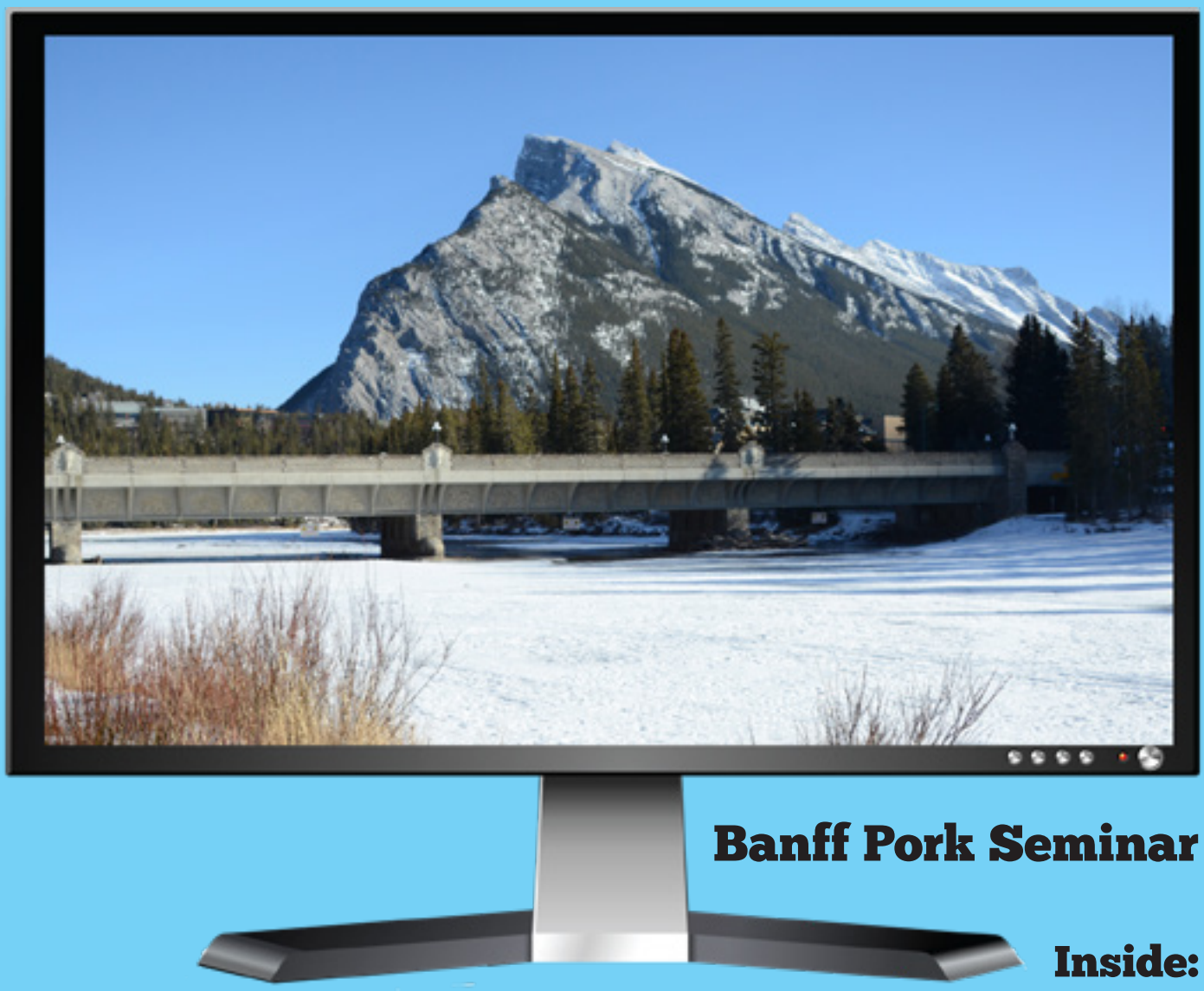
BANFF 2021

Canadian Hog JOURNAL

Canada's national hog magazine



Banff Pork Seminar

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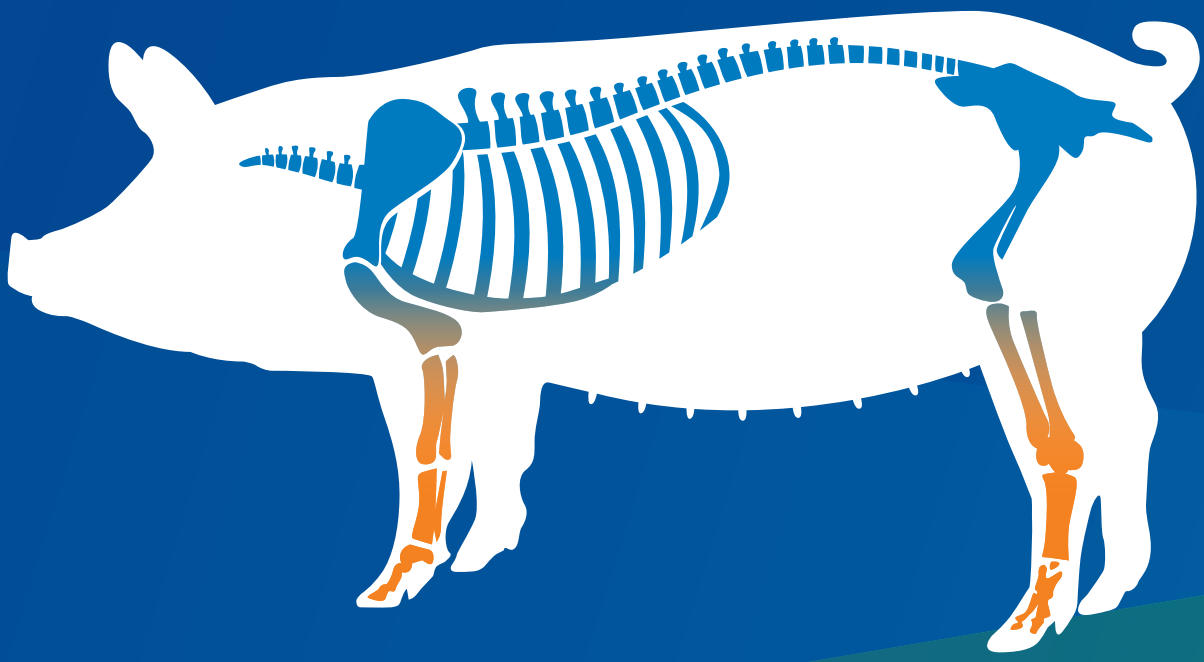

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Cover Photo
Bow River Bridge in Banff, Alberta.

Foreign feed can be a dangerous gamble

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Canadian Hog Journal Message from the editor

The Banff 2021 edition of the Canadian Hog Journal is here!

This year's Banff Pork Seminar adopted the theme, "Resiliency in a New World." In this edition, you will notice that theme woven into the various pieces of coverage and commentary on the presentations delivered during seminar, including topics on economics, disease management, mental health, awards, research and more.

The first-ever Banff Pork Seminar took place in 1972, following an earlier prototypical event held at Olds College, a renowned agricultural institution located about 100 kilometres north of Calgary. Since then, the event has taken place at a handful of venues in the Banff area. From the beginning, the seminar was jointly organized by the University of Alberta, Alberta Pork and the Government of Alberta. The partnership remains unbroken to this day. Prior to COVID, the seminar's advisory committee had planned to mark the 50th anniversary this year with special in-person festivities. Sadly, we will have to wait for that celebration, but hopefully not too long.

The cover of this edition of the Canadian Hog Journal features Banff's bridge over the Bow River, constructed in 1923. Adorned with First Nations reliefs and located in the historical lands of the Stoney-Nakoda people, the bridge connects us through time, distance and relationships. The same bridge today connects the seminar's usual location – the Banff Springs Hotel – with the main townsite to the north.

Over the years, our industry, country and the entire world have changed in so many dramatic ways. COVID-19's impact and the Banff Pork Seminar's virtual format this year are a contemporary reminder of how the passage of time can impact choices and alter perspectives. The Canadian pork industry has no shortage of issues that still require mending, but if we can continue establishing honest connections, rather than making excuses for dysfunction, our future looks bright, despite any existing grievances.

The image included in this 'Message from the editor' was captured at the 2019 Banff Pork Seminar – my first since entering this industry in June 2018. From left to right, the photo includes Michael Young (former Vice

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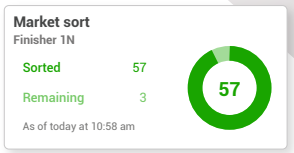

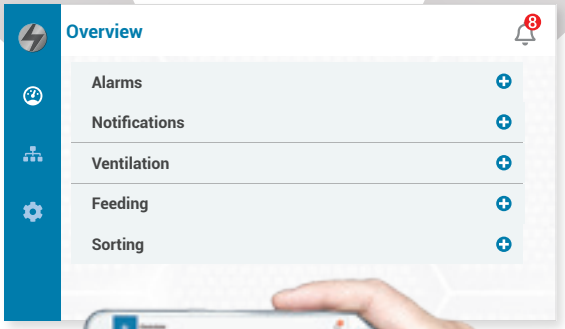

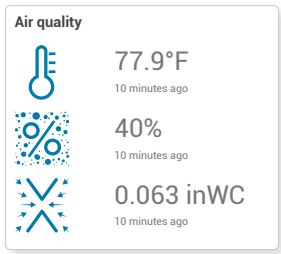

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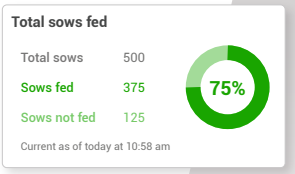

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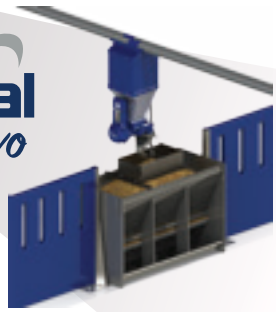

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Message from the editor

President, Canada Pork), me, Marvin Salomons (farm labour consultant, Salomons Group Solutions) and Ron Gietz (former extension economist, Alberta Agriculture and Forestry) – all gentlemen whose depth of knowledge and experience eclipses mine, but certainly positive role models and reminders of the long-term commitments that so many in this industry have made. It is invaluable encounters like these that we lose with a virtual conference, which is unfortunate, but as this year's seminar theme confirms, resiliency has long been a hallmark of agriculture. We will return.

What are some of your favourite memories from the Banff Pork Seminar? I would love to read those stories and share them in the next 'Letters to the editor' section. Reach out to me by emailing *andrew.heck@albertapork.com*. ■

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High grain prices drive feed costs

Bijon Brown

Editor's note: Bijon Brown is the Production Economist for Alberta Pork. He is currently collecting and analyzing cost and pricing data to improve producer success. He can be contacted at bijon.brown@albertapork.com.

"Listen to the whispers, not the big headlines, in the market," said Joseph Kerns, as he opened his keynote presentation during the 2021 Banff Pork Seminar. Kerns is the President of Iowa-based Kerns & Associates, with 30 years' experience working with producers, suppliers and feed mills to support agricultural operations.

In his presentation, Kerns provided an overview of three economic topics of interest for 2021: the U.S. grains market, the U.S. livestock market and the actions that can be done to safeguard producers' financial well-being.

Current grain price surge reflects tight U.S. supplies

"The grain market has awakened from its slumber... For the last five years, I have been saying, 'The grain market is boring, guys – don't worry.' Now I am changing my song," said Kerns.

U.S. supplies of both corn and grain are limited, based on last harvest and the outlook for supplies. With the downward revision to U.S. Department of Agriculture (USDA) numbers, wind damage and drought-like conditions in the late summer to fall, corn harvest numbers in the U.S. fell to almost half of initial expectations.

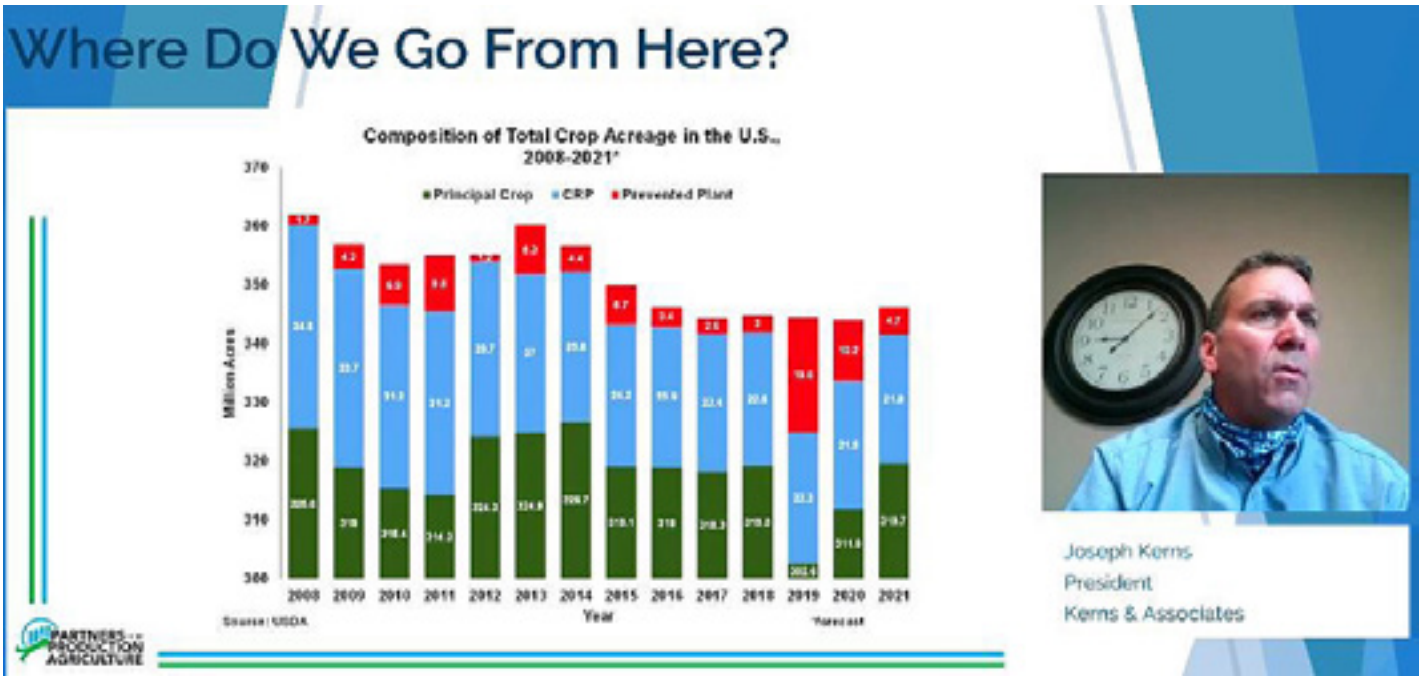
Looking forward into this upcoming crop year, as dry conditions remain in the major grain-producing regions of the U.S., and with expected fulfilled sale commitments to China, supplies are predicted to remain tight. A mitigating factor is that ethanol stocks were extremely high in 2020 due to a fall in demand for gasoline, driven by COVID-19. As such, it is expected that corn demand for ethanol will remain subdued, as the market adjusts its inventory. Kerns highlighted that, even with a bumper crop in 2021, ending stocks should remain average at best, meaning prices should stay high.

And it is the same story with soybeans, which are benefiting from strong demand in Asia. This is coupled with drier conditions due to *La Niña*, the colder counterpart of *El Niño*, both of which are oceanic-atmospheric phenomena that impact weather in South America. These factors have strained global supplies and resulted in higher soybean prices.

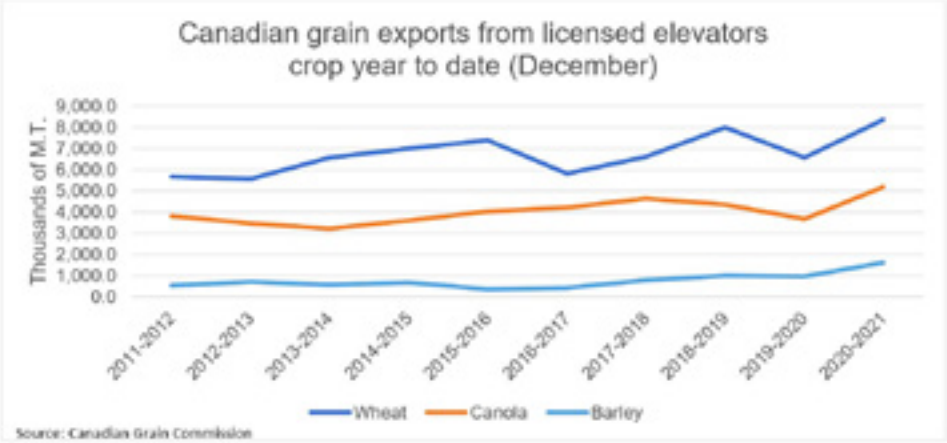
Outlook stable for U.S. packers, grim for producers

The USDA hogs and pigs report indicated a massive number of pigs would have been due to show up for slaughter toward the end of 2020 and in the new year, but this has not materialized so far. Nevertheless, the U.S. market is awash with hogs, and packers, therefore, are able to buy cash hogs cheaply and make a decent return on sales.

Kerns indicates that packer margins are expected to remain healthy at the expense of producer profits. While revenues are



Joseph Kerns believes the grain market could potentially have a significant impact on hog margins in the coming year.



Increased wheat and barley exports from Canada to China have driven domestic feed prices upward.

expected to be higher this year, rising feed costs are expected to erode profits, and producers are expected to break even, at best. Despite another year of mediocre profits for producers, Kerns projects a slight increase in production numbers, mainly due to productivity gains. If feed costs remain high, he expects weights to decline.

Likewise, cattle producers could be looking at a bad year, as there are too many animals on feed, facing the same cost problems as hog producers. In the dairy sector, the milk futures price is below cost of production. While there were some downward adjustments to U.S. broiler chicken production in the spring of 2020, production bounced back toward the five-year high by the fall of 2020. As such, broiler prices remained below the five-year average.

China still exerts major influence on hog markets

Ever since the African Swine Fever (ASF) outbreak that decimated half of its herd, China has transitioned more of its domestic production from backyard farms to American-style mega farms. Along with the ban on feeding human food scraps, there is now and will continue to be increased demand for feed grains.

Inclement weather experienced during China's growing season did not boost supplies and has resulted in significant draws on world grain supplies. While China's activity in the U.S. pork market has had a muted effect on U.S. prices, global events have exacerbated activity in grain markets. U.S. exports of soybean meal and corn continue to surpass previous highs and continue to drive grain shortages.

Locking-in could help producers prevent losses

Kerns recommends that producers use the economic tools available to hedge or lock-in some value. He highlighted that the pork cut-out futures contract provides either a one-to-one hedge if a producer's current contract is based on the pork cut-out, or a basis hedge on the difference between cash and cut-out values.

Based on his economic projections, Kerns expects some cost-push inflationary pressure, and with it, higher interest rates. He recommends that producers who have the ability to lock-in at low interest rates or exercise an interest rate swap should do so now.

What does this all mean for Canada?

In Canada, there has been a similar trend with crop year-to-date exports for wheat, canola and barley at 10-year highs at the end of 2020. Barley exports to China have doubled, and wheat exports have jumped almost five-fold. These significant drawdowns have tightened supplies and lifted domestic grain prices. With U.S. supplies being tight, there is always the possibility of Canadian grain being pushed south of the border. Nevertheless, there was no significant movement in this regard based on the data for the crop year-to-date in December 2020.

If strong demand out of China persists and U.S. supplies continue to be tight, then this could mean grain prices remain elevated for the foreseeable future. Like U.S. hog producers, it is expected that Canadian hog producers' revenues could be eroded by the higher cost of feed, despite the possibility of higher hog prices.

While publicly available hog and pork pricing data from Canadian packers is limited, Canadian pork export data indicates that revenues have jumped by almost 18 per cent. While, historically, the U.S. was once the largest export market for Canadian pork, 2020 bucked the trend, as most Canadian pork was diverted to the meat-deprived Chinese market. In 2020, nearly 40 per cent of Canadian pork exports went to China, more than double the volume in 2019. The growth in 2020 resulted in marginal declines in exports to both the U.S. and Japan.

Overall, the previous two years of Canadian pork export values and volumes, along with projections for 2021, indicate significant boosts to packer revenues, while producers have struggled to recover cost, let alone earn a profit. ■

Foreign feed can be a dangerous gamble

Andrew Heck

Disease spreads fast; news, even faster

January 8, 2019: as Alberta Pork's communications coordinator (but not yet editor of the Canadian Hog Journal), I showed up to the Alberta Pork office in Edmonton in the morning, overnight bag in-hand, ready to gather with two colleagues, load up the vehicle, and head to the Banff Pork Seminar. There was just one problem: Alberta had discovered its first-ever case of porcine epidemic diarrhea (PED) at a 400-head farrow-to-finish operation.

Immediately, the focus quickly turned from a relaxing four-hour drive to a pressing need for communicating what we knew about the outbreak, which was little, other than a confirmation of the virus's presence. PED is a provincially reportable disease, meaning it would not have been long before the public caught wind of the news through one channel or another. In the interest of prudence and transparency, Alberta Pork wanted to get ahead of any potential rumours or misinformation.

After receiving the basic details of the incident, I hammered out a news release, posted it to the Alberta Pork website, and made my way to Banff alone, as our Quality Assurance and Production Team (Javier Bahamon and Cris Neva) stayed behind to assist incident command efforts alongside government officials, including visiting the affected farm to support the producer during that time of extreme difficulty.

By the time I had arrived in Banff, the PED case was already the talk of the seminar. Social media has a way of moving quicker than a truck on the highway. And while PED first entered Canada from the U.S. in 2014, it was unclear exactly how PED made it to Alberta from eastern Canada in 2019. And now, two years and three more PED-positive cases later, 'presumptive negative' status has been granted to all four previously affected farms, thanks to the hard work of so many people in the industry to stem the spread.

But a bigger question still remains: *how did it happen?*

Feed ingredients from disease-positive countries are known to contribute to viral spread in countries where those ingredients are imported without any legal restrictions.

Scott Dee delivered an eye-opening presentation on feed biosecurity at the 2021 Banff Pork Seminar.

Alberta Pork's environmental disease surveillance program is always on guard to protect the industry, performing thousands of routine tests annually with the cooperation of farms, assembly yards, processing facilities and truck washes. While theories exist, Alberta's 2019 PED cases still have uncertain origins, despite intense investigation – such is the nature of this incredibly complex problem. Many have speculated that porcine plasma is likeliest culprit, though this has never been confirmed.

Viruses move through contaminated feed

At the 2021 Banff Pork Seminar, Scott Dee of Minnesota-based Pipestone Veterinary Services presented, "Feed biosecurity: the new normal for North American agriculture." Prior to May 2013, when PED first entered the U.S., feed ingredients were largely overlooked as potential vectors for pathogens to spread. The link between swine diets and disease has been further investigated over time to take a specific look at PED and African Swine Fever (ASF).

Experimental data collected by Pipestone's researchers, led by Dee, has dem-

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onstrated that some feed ingredients can support the viability of pathogens. After PED started to spread in the U.S., three separate farms in the states of Minnesota, South Dakota and Iowa – clients of Pipestone – experienced simultaneous outbreaks. It was determined that feed bins on all three farms had been refilled at the same time, using the same supplier, and by the time that refilled feed was consumed by the respective farms' sows, PED was quick to follow. It was this finding that prompted a deeper dive – for real.

"I was literally leaning over the feed bin with a long pole and a paint roller, and I was scraping the inside, collecting that feed material," Dee recalled. "We brought it over to South Dakota State University and fed it to pigs. They consumed it, and within three or four days, they had clinical signs of PED virus."

Dee's test resulted in the first known demonstration of how PED could be transmitted to pigs through feed. More recently, in the case of ASF, virus survival has been successfully confirmed in nine distinct animal and human foods, including three soy products, choline chloride, three pet diets, pork sausage casing and complete feed exported from China to the U.S.

When ASF was discovered in China in 2018, contaminated food scraps imported from Russia were to blame, as this waste was bought cheaply by Chinese producers and fed to pigs. The issues inherent to feeding food scraps to pigs were covered in the Winter 2021 edition of the Canadian Hog Journal: "Feeding scraps is no solution to food waste." From contaminated food scraps, farm-to-farm transmission of ASF was swift.

As a result of ASF, based on varying reports, China's sow herd was reduced by nearly one-half between late 2018 and early 2020, but the Chinese hog industry has been bouncing back, with special considerations given to feed. In response, the Chinese government has since banned feeding human food scraps to pigs, and conventional feed ingredients are now being handled with greater caution.

"Nobody really knows how many sows there are in China, but clearly there's a rapid growth of the national herd. It's big bucks," said Dee. "About the feed risk, the Chinese are very concerned. Everything's pelleted in China. They put feed through an extensive heating process by cooking it at 85 degrees Celsius for three minutes before the pellets are used."

Not all feed ingredients are equal

Turning their attention to specific feed ingredients, Pipestone researchers decided to measure ingredient survival times and noted a stark difference between most ingredients tested and one which stood out: soybean meal.

"We held the ingredients outside in January, in Minnesota, so it was very cold," said Dee. "We sampled them monthly, and in a handful of ingredients, we found live virus over time."

According to the test results, live PED virus was detected in soybean meal more than 180 days later, whereas the virus had disappeared in most other tested ingredients within only 40 days. The soybean meal results suggest that surviving a hypothetical transcontinental journey from China is more than possible – in fact, quite likely.

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Pipestone's test results of survival rates by type of virus and contaminated feed ingredient. Soy appears disproportionately risky.

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This discovery led the researchers to think harder about how grain-drying practices in Asia could contribute to the contamination of feed. Much of that grain-drying, prior to ASF, was being performed in the open air, using traffic from people and motor vehicles to crush the grain and encourage moisture evaporation, along with the unintended consequence of disease transmission. Recognizing that this practice may have been responsible for helping spread ASF, Chinese officials have since tried to streamline and sanitize the process using modern facilities with strict biosecurity protocols, including Danish-entry-style precautions.

In 2018 and 2019, three-quarters of U.S. soymeal imports came from China, Ukraine and Russia – all three of which are ASF-positive countries. By 2020, that number had declined, but the U.S. imports close to 500,000 tonnes of soymeal annually, while exporting a staggering 50 million tonnes of its own. Though the massive discrepancy is not necessarily surprising to market analysts, it might alarm producers and other industry partners to know.

"It's like a teeny, little needle in the haystack. It's silly we even have to deal with that," said Dee. "But that's the way things work these days in global trade. So that's crazy, when you think about it."

Soy it ain't so

From human food scraps as pig feed to soy-based goods for human consumption, products containing phytoestrogens, including soy products, are suspected of potentially leading to gradual hormonal imbalance in those who eat them in excess. As such, the reputation of soy used in human food has taken a hit over time, as consumers become more discerning with their choices.

Could soy imported for human food possess the same risks as soy imported for pig feed? Dee draws no distinction between the soy format – only its origin.

"The risk of soy is independent of whether it comes in for animal feed or human food," said Dee. "The product is a vehicle to bring the virus into a country."

According to the Good Food Institute – a U.S.-based non-profit that supports plant-based businesses – upwards of 79 per cent of soy protein isolate, 50 per cent of textured soy protein and 23 per cent of soy protein concentrate used worldwide is sourced from China.

According to Nielsen – the Canadian-based global measurement and data analytics company – the meat and dairy alternative market in Canada was up by 31 per cent in value in 2020, worth nearly $300 million. The largest single player in that space, Yves Veggie Cuisine, was founded in 1985 to satisfy a "growing demand for healthy, ethical plant-based products." Yves' lineup of nearly 50 separate offerings includes mostly simulated meat products using textured soy protein as the dominant ingredient. Yves' website does not disclose ingredient sourcing, apart from indicating that products are manufactured in Canada using domestic and imported ingredients.

"Although ingredients are predominantly sourced domestically, it is sometimes necessary to source globally," an Yves product specialist wrote in an emailed response. "This is due to the fact that some ingredients are not available domestically or the domestic sources are limited based on market demand."

Could the import of foreign soy for human food similarly risk the Canadian livestock industry simply by its presence in the country? Canadian soybean meal imports have hovered around one million tonnes annually in recent years

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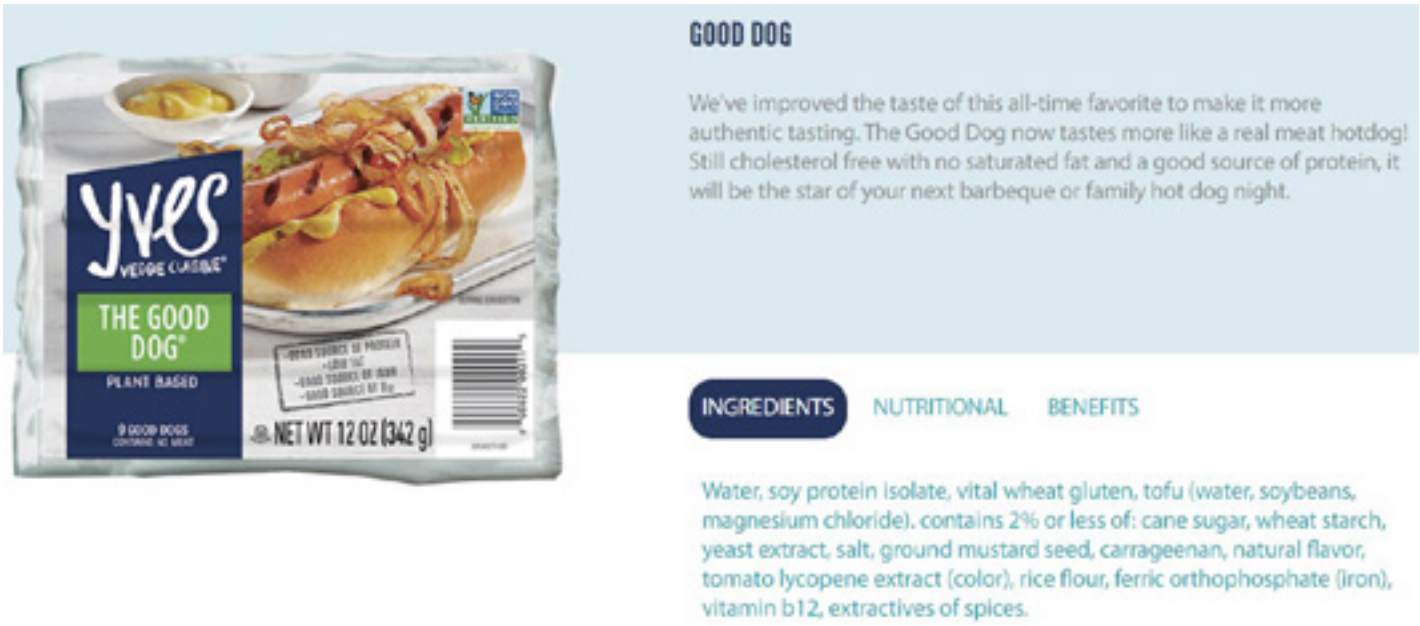

Could soy-based human food products using imported ingredients present a similar disease risk to imported animal feed?

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and peaked at more than 1.5 million tonnes in 2007, while the use of soy in human food products has steadily risen since then. Understanding what is driving this demand in either the animal or human food sectors is important.

Buyer beware – biosecurity matters

Can biosecurity guarantee a disease-free farm? No, but it can help reduce the risk. Biosecurity, together with understanding where feed ingredients are sourced, can help producers protect themselves against what looks to be a growing threat to animal health around the world.

Across Canada, feed ingredient composition varies, but Canadian pork is noted in lucrative markets globally for having a distinctive profile that comes from the inclusion of barley and wheat in diets. Corn and soy may be more widely available and less expensive in some regions, but when soy especially has its origins in ASF-affected countries like China, this should be a red flag for producers to pay closer attention.

Even the strictest biosecurity can still result in disease incursions within a herd, but it is better to be safe than sorry. Feed tops the lists of costs for producers today, and saving money in that area may appear compelling. An increasing cost of production, together with reduced revenue, has been a crippling barrier for many Canadian producers in recent years, and industry stakeholders must work together to ensure the long-term sustainability of the sector, which includes protection against disease. Recognizing the cost of that work will be important for everyone to consider and act upon. ■

The Canadian Pork Council (CPC) recommends holding any imported feed at 20 degrees Celsius for 20 days or 10 degrees Celsius for 100 days.

E. coli cross-contamination affects pigs and pork

Andrew Heck

Foodborne illness has long been the bane of the agri-food industry. A first-hand encounter with the gut-churning, mind-altering discomfort and fatigue of sickness caused by contaminated food is something no-one wants to experience. While a brutal time sitting on the toilet, laid out on the couch or delirious in bed is bad enough, it can, in fact, be much worse.

Such was the case for one poor woman in March 2018, who died after eating at a restaurant in southeast Edmonton. The culprit: *Escherichia coli (E. coli)* O157:H7, which was consumed in a pork-based dish that was improperly cooked prior to serving. Even when bacteria like *E. coli* and other related pathogens are present, they can be eliminated when food is cooked thoroughly to a safe internal temperature. This is sometimes difficult when food is consumed raw, like in salad, but the problem is largely avoidable in meat, if proper handling and cooking practices are used.

In 2018, pork contaminated with E. coli O157:H7 was served at a restaurant in Edmonton, causing more than 42 human cases of illness, including one death.

In response to the 2018 outbreak, the Canadian Food Inspection Agency (CFIA) issued a recall of all products from the affected on-farm processor that supplied the restaurant and sold products to other consumers. While the recall was a necessary precaution, it resulted in some negative attention toward the farm – a regrettable reputational hit for the entire pork industry. But, as such, it became imperative for research to address the many questions being asked.

Now, a team of scientists in Alberta is coming out with answers. At the 2021 Banff Pork Seminar, postdoctoral researcher Peipei Zhang, with Xianqin Yang's research group at Agriculture and Agri-Food Canada's (AAFC) Lacombe Research and Development Centre, presented a poster exploring one aspect of the issue, prompting a closer look at the bigger picture.

E. coli in pork?

Until the 2018 incident, pork had never been implicated in any deaths in Canada due to *E. coli*. This realization caused confusion among industry observers, even to the point that some initially doubted it was possible.

"When I first heard that someone had died from eating pork contaminated with *E. coli* O157:H7, I didn't believe it," said Saida Essendoubi, a surveillance scientist with Alberta Agriculture and Forestry, and the leader of the *E. coli* research group. "How can this be? We had only seen this in beef before, but it turns out pigs are vulnerable too, even at the farm where this pork came from, which has very good biosecurity."

What makes *E. coli* O157:H7 potentially lethal? 'Shiga toxins,' named after Kiyoshi Shiga, a Japanese researcher who discovered *Shigella dysenteriae*, in 1897. Eight decades later, in 1977, researchers in Ottawa with the Bureau of Microbial Hazards, Health Protection Branch, Health and Welfare Canada discovered the Shiga toxin normally produced by *Shigella*

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dysenteriae in a line of *E. coli*, which includes the O157:H7 strain. Ingestion of Shiga toxins can result in abdominal pain and watery diarrhea. In serious instances, these symptoms can be life-threatening, as was the 2018 case in Edmonton.

Cattle are a natural reservoir of *E. coli* O157:H7. In contrast, studies have found very low prevalence of the organism in pigs and, consequently, very few pork-related *E. coli* O157:H7 outbreaks have ever occurred. However, in addition to the 2018 case, two more previous non-lethal outbreaks were discovered in Alberta in 2014 and 2016, attributed to the consumption of contaminated pork at the food service level.

Finding the source of E. coli O157:H7 in Alberta meat

With the consideration that *E. coli* O157:H7 is known to inhabit cattle feedlots in southern Alberta, an obvious red flag was raised regarding premises that keep both cattle and pigs on-site, with assembly yards and mixed farms being places of interest.

"When people move from one part of a site to another without changing their boots, for example, there is potential for pathogen transmission," said Javier Bahamon, Quality Assurance and Production Manager, Alberta Pork. "Back when porcine epidemic diarrhea (PED) first spread in Alberta, the question was whether the four cases were directly connected. Three of the four impacted sites were within a 20-kilometre radius of each other, suggesting farm-to-farm spread. But while no individuals or vehicles were found to have travelled directly between those farms, there is a possibility that individuals or vehicles from those farms crossed paths with each other at a neutral site. The possibility for this kind of transmission is alarming not only for spreading PED but also *E. coli* O157:H7, considering how many cattle premises are in proximity to hog premises in Alberta."

E. coli O157:H7 is known to exist in cattle, often being transmitted at feedlots. But for a long time, no-one suspected pigs too could be affected.

To evaluate the southern Alberta assembly yards and mixed farms' connection to the meat processing sector, Essendoubi, Bahamon, Yang and other researchers began collecting carcass and colon samples at provincially inspected abattoirs across the province.

More than 500 carcass samples were also analyzed for generic *E. coli* and aerobic colony count, which refers to the total number of bacteria able to grow in an oxygenated environment – an indicator of microbial quality of food. Of all the carcass samples collected, nine were confirmed positive for *E. coli* O157:H7, representing nearly two per cent of the total, which is consistent with existing literature worldwide. Similarly, seven of the colon samples tested positive. These positives were found across five of 39 abattoirs visited, from hogs originating at eight different farms.

Understanding the E. coli O157:H7 genome

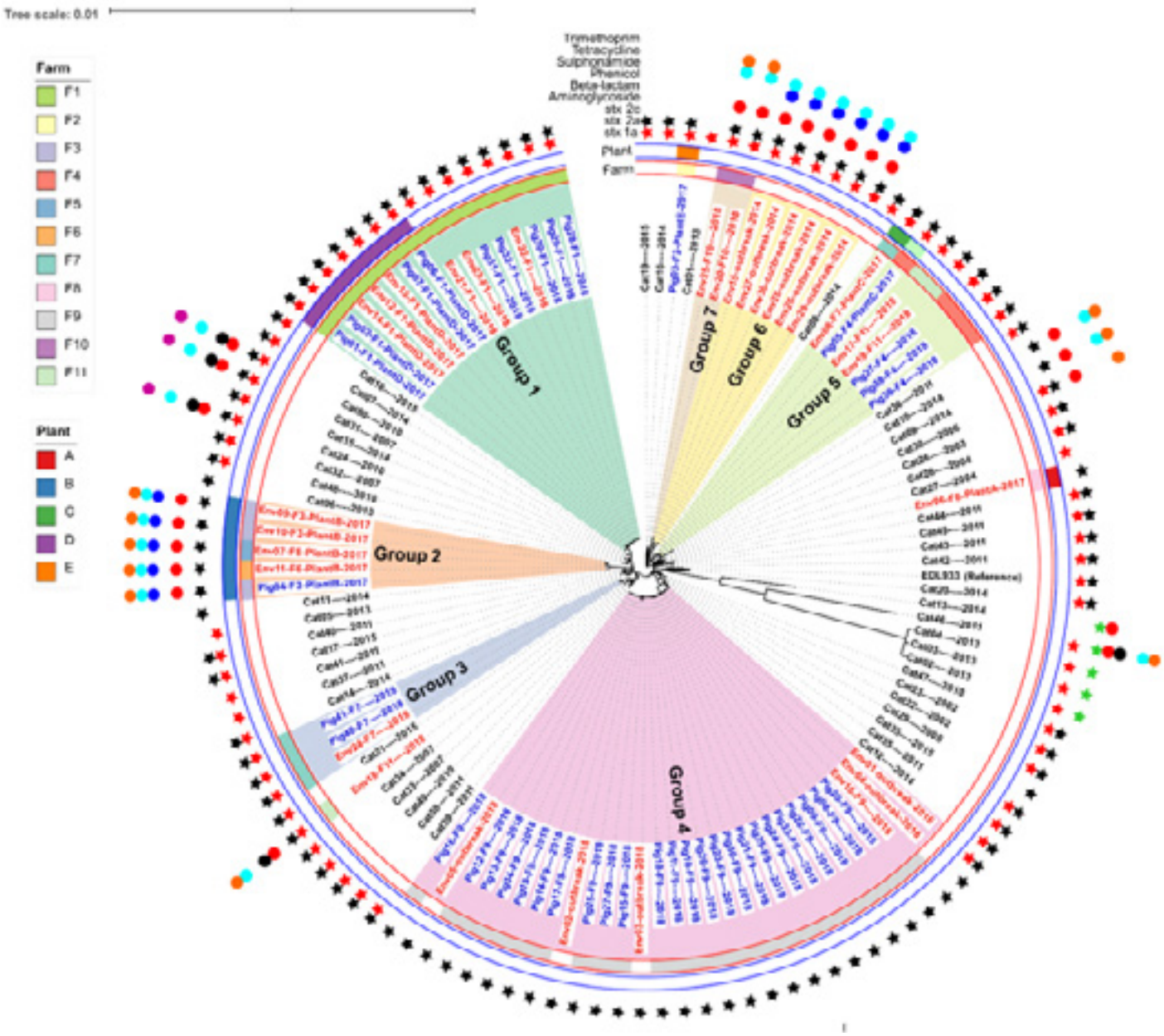
To explore the potential source of *E. coli* O157:H7 contaminating pork, Zhang undertook an investigation into the phylogenetic relatedness of the bacteria in pigs and cattle on-farm, along with pork processing facilities. This work was led by Yang in collaboration with other researchers, with funding from Alberta Innovates.

Whole genome sequencing is a promising technology for tracing the origin of bacteria. This technique was the first choice for discovering the relationships between *E. coli* O157:H7 in pigs and cattle on-farm and within packing plants. Because *E. coli* O157:H7 genome sequences originating from pigs are limited in public databases, Yang and Essendoubi, in collaboration with Kim Stanford and Tim Reuter from the University of Lethbridge, decided to sequence *E. coli* O157:H7 strains gathered from pig and cattle feces, for comparison.

The study relied on whole genomes obtained first-hand by the researchers, in addition to data sourced from the U.S. National Center for Biotechnology Information – known as 'GenBank' – which was the best source of existing data at the time. Gene subtyping based on whole genome sequencing data revealed that nearly 95 per cent of the samples were closely related strains, with further analysis indicating that these strains all had a common and recent ancestor.

The researchers decided to dig deeper into the genetic characteristics of *E. coli* O157:H7. Nearly 61 per cent of pig isolates harboured one Shiga toxin variant, while 70 per cent of the cattle isolates carried two variants. The variant harboured by most of the pig isolates is associated with more severe outcomes. Analysis also shows that similar strains can be repeatedly isolated from pig gut contents over a period of up to two years, strongly suggesting pigs can, in fact, be a source of *E. coli* O157:H7 – the definitive finding that confirmed suspicions.

Never before could it be proven that sites common to cattle and pigs were able to support the transmission of *E. coli* O157:H7, uncloaking the mystery of the contaminated, under-



Matrix of test results categorized by various isolates, animal species (pigs or cattle) and location (farm or plant).

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cooked restaurant pork and setting the research team on the path to supporting an enhanced approach to managing the disease risk.

Preparing the industry for the future

Food safety is everyone's responsibility, from producers and processors, to food service and retail, and consumers at home. Regardless of the reasons surrounding the 2018 death connected to *E. coli* O157:H7, the entire Canadian pork industry is doing its part to prevent any further harm by better understanding the issue and preparing stakeholders to manage risks.

"Adapting and performing biosecurity assessments to account for *E. coli* O157:H7 will be an important next step," said Essendoubi. "Alberta Agriculture and Forestry, working with Alberta Pork and other organizations, will begin to focus its attention on helping industry partners manage risks."

Observable clinical signs of illness related to *E. coli* O157:H7 are non-existent, meaning efforts to educate producers will have to be very proactive. From clothing and visitor biosecurity protocols to better rodent management in barns, vulnerabilities within production remain an ongoing threat.

"We have to get producers to take this seriously," said Bahamon. "Foodborne illness is a human health matter. Consumers care. As much as producers are rightly concerned with swine diseases and their impact on production, our social licence to operate as an industry depends on public trust in our food safety systems."

When and where will the next *E. coli* O157:H7 outbreak connected to pigs occur? Hopefully, never and nowhere, but even with due attention to the matter, the industry may have to expect that future outbreaks are, unfortunately, not out of the question. Producers can and should protect themselves by reviewing their on-farm biosecurity.

Organizations like Alberta Pork, Alberta Agriculture and Forestry, Alberta Innovates, AAFC, CFIA and other industry partners are currently working to ensure all stakeholders have the knowledge and tools they need to reinforce food safety and consumer confidence. ■

Biosecurity protocols, including rodent control, will be crucial for producers to stem the spread of E. coli O157:H7.

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Microencapsulated zinc to protect your herd and environment

Glenmer Tactacan, Ph.D., Jefo Nutrition Inc.

Pharmacologic concentrations of zinc oxide (2000-3000 mg/kg) are commonly fed to newly weaned piglets to control diarrhea and improve growth rate. The growth-promoting benefits from ZnO are likely associated with improvement in gut health including improved intestinal morphology, reduced intestinal inflammation, enhanced tight junction integrity, and positive influence on the gut microbial profile particularly with respect to *E. coli*. Unfortunately, feeding high levels of ZnO may favor the development of bacterial resistance to Zn and may play a role in antibiotic resistance. In addition, high dietary ZnO leads to excessive fecal Zn excretion that can accumulate in the soil and thereby represents a serious environmental concern. The European Union voted in favor of phasing out pharmacological ZnO by 2022.

Microencapsulated ZnO can be a good alternative as it works equally as pharmacological ZnO in reducing the incidence of diarrhea and improving the growth rate of nursing pigs even when supplemented at relatively low dose rates. Microencapsulated ZnO is made with a matrix of triglycerides especially designed to facilitate the targeted release of ZnO in the small intestine where it can exert its gut-health promoting effects. Additionally, the protective matrix reduces the acid binding capacity of ZnO which if not protected, can freely react to HCl acid in the piglet's stomach or alternatively interact with other essential minerals lowering their digestibility. As the digestive system of the piglet is immature and the secretion of acid is low, a feed additive with high acid binding capacity will impair the digestibility of proteins and leads to diarrhea and poor growth.

This prevents its solubilization which leads to significant endogenous losses. In addition, the targeted release of ZnO in the small intestine prevents its buffering effect in the piglet's stomach. After being released in targeted delivery, high purity pharma grade Zinc Oxide with its very small particle size, helps to decrease the adhesion of pathogenic bacteria to intestinal cells thanks to the adhesion of zinc to the fimbriae of pathogenic *E. coli* to prevent incidence of non-specific diarrhea in growing piglets.Ultimately, the microencapsulation of ZnO effectively reduces its use in the piglet diet resulting indecreased Zn excretion in the manure and a negative impact to environmental pollution.

Protected Zinc Oxide reduces ZnO levels in piglet diets, thereby reducing Zn excretion in manure, and at the same time maintaining the same level of performance.

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Finding a light in the mental health labyrinth

Gerry Friesen

Editor's note: Gerry Friesen is a former hog farmer from southwestern Manitoba. Today, he shares his lived mental health experiences for the benefit of farmers and organizations across Canada.

When I hear presentations on mental health in agriculture, such as the ones delivered by Andria Jones-Bitton and Robyne Hanley-Dafoe at the 2021 Banff Pork Seminar, I am compelled to reflect on my journey in the labyrinth of stress, anxiety and depression.

I call myself 'The Recovering Farmer' for two reasons: number one, because we sold our family farm some years ago to pursue other interests, and number two, due to my struggles with mental health.

I am often asked what it means to recover. The dictionary defines it as, "returning to a previous state of health, prosperity and equanimity." 'Equanimity' is a big word, so I checked that as well. It means to, "have an evenness of temper even when under stress." That, in a nutshell, has been and remains part of my journey.

I grew up on a turkey and grain farm. After graduating from high school in 1978, I joined the workforce for a few years, found a life partner, and was drawn back to the family farm in 1983. Growing up, I had never envisioned myself being a hog producer, but because turkey quota was not readily available, we had to diversify into something else to support two families – so hogs it was.

In the 1980s, my focus and priority was the farm. In the 1990s, I was involved in agricultural politics, serving on the boards of Manitoba Pork, the Canadian Pork Council (CPC) and Keystone Agricultural Producers. In the 2000s, I became immersed in farm debt mediation – something that became life-changing, as I saw a new career path unfold in front of me. And then, since the start of the 2010s, I have been passionate about mental health, particularly in agriculture.

Given how many times I reinvented myself and my career, I often wondered whether I truly was a farmer at heart. In 2007, as I was winding down the farm, I met a feed salesman whom I had gotten to know through my involvement in the hog industry. He asked how I was doing. I told him about winding down and selling our farm, and I suggested to him that I did not think I was a farmer anymore. He looked me in the eye and said that perhaps I never had been.

That statement that night gave me reason for pause and reflection. In my mind, there were different ways of looking at this. Either I was a farmer but had failed miserably, or perhaps my natural aptitude was for other work. Clearly, for the sake of my dignity, I am going with the latter.

Friesen's first-hand encounters with farm life, family and finances have afforded him a genuine perspective on mental health in agriculture.

Industry issues generate widespread stress

As evidenced by the national survey of farmers headed by Andria Jones-Bitton, agriculture comes with a host of stressors – some that are obvious and some that are not. And not only at the Banff Pork Seminar, but going forward, I would encourage you to explore the many resources available for managing stress, including the 'In the Know' program developed by Jones-Bitton's team, which is freely accessible.

Although certain stressors are general to any farmers, livestock production inherently come with some unique ones. Many farmers are able to rise to the occasion – meeting stress head-on and managing it. For me, it was never that simple.

When we started with hogs, our feed company partner convinced us to try a recently developed nutrition program. It sounded great. We bought our first batch of pigs, and off we were! It did not take long to realize we were having issues. Long story short, our mortality that first year was 33 per cent. Due to a high-density, finely-ground feed, our pigs were getting gastric ulcers. As much as insurance finally kicked in, it was a tough start.

Hog markets have always been cyclical, and certain events during my time as a farmer stand out to me. In the 1980s, U.S. countervail duties impacted our prices. In the 1990s, as the industry adopted pricing formulas based on a North American marketplace, our currency played a major role in establishing value. A low Canadian dollar exchange rate

Andria Jones-Bitton's survey highlighted the many sources of stress affecting Canadian farmers. Some, like finance, are obvious enough, but others, like social pressure, are more contemporary concerns, fuelled by social media.

benefited live hog exports to the U.S. for a few years. We were seeing a lot of promise for growth, until the Canadian dollar began to rise, and profits declined significantly. Add to that issues such as mandatory country-of-origin labelling (mCOOL), and you get a picture of how volatile markets can be.

In early 1998, we expanded our hog operation. Just as the production from that expansion was ready for market, the prices plunged to $0.42 per kilogram. That meant that we were marketing hogs at a $140 cost of production, with a market return of just under $40. Anecdotally, it was suggested that hog producers lost 15 years of equity during that time.

Then it became a constant struggle to stay on the right side of the ledger. There was the ongoing attempt to balance business risk management programs with the variabilities of markets. And when that did not work, we restructured. But it never seemed to be a lasting solution. I was often reminded of how my production was enough to feed a small city, but I was having trouble feeding my family.

Government policies were a constantly moving target. There was continued pressure and scrutiny regarding environmental issues and animal welfare. We experienced trade disputes. Today, various disease issues such as porcine epidemic diarrhea (PED) and African Swine Fever (ASF) are ongoing threats to the hog industry. Whenever and wherever you look, there is always some kind of issue threatening hog farmers. At least that much of the experience we all share!

From the political to the personal

Operating a farm comes with many stressors not only from an external point-of-view but also from an internal point-of-view. Maintaining a work-life balance while trying to manage the barn around the clock is a different kind of stress altogether.

In 2003, I was president of Manitoba Pork Marketing, chair of Dynamic Pork and an active mediator with the Manitoba Farm Mediation Board. The hog industry was in a continuous downward spiral, and likewise, so was my farm, as many others in the industry were also experiencing significant challenges.

During a mediation meeting in the fall of that year, I suddenly felt my heart do some interesting palpitations. I felt a shortness of breath and thought I would pass out. It came and went relatively quickly, but it started happening on a more frequent basis to the point where, in early 2004, I sought help from a physician. He explained that I was experiencing anxiety and depression, and that I needed to go on medication. With little to no thought about the intricacies of mental illness, I took the meds. That was the beginning of my recovery – discovery, not so much.

Combined with my ongoing mental health issues and increasing stress, my behaviours started changing. Most notable was an increase in expectations for myself and for others. I could do nothing right and neither could anyone else in my life. My self-esteem reached new lows, which created tension in my relationships with those closest to me.

My coping mechanisms were not particularly helpful. I found out that alcohol does an amazing job of easing anxiety. Unfortunately, as alcohol leaves the body, it increases anxiety. So, the only way to combat that is to drink more, which I did. When I was not in a self-medicated fog, I was finding other means of escaping. I found the hog barn to be a sanctuary –

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Friesen has shared his story in-person with attendees at many conferences over the years, including Manitoba Ag Days, in 2010. More recently, he has addressed other farm-based events and groups virtually.

away from people, away from my phone, away from my family, and, perhaps, even an attempt to escape from myself.

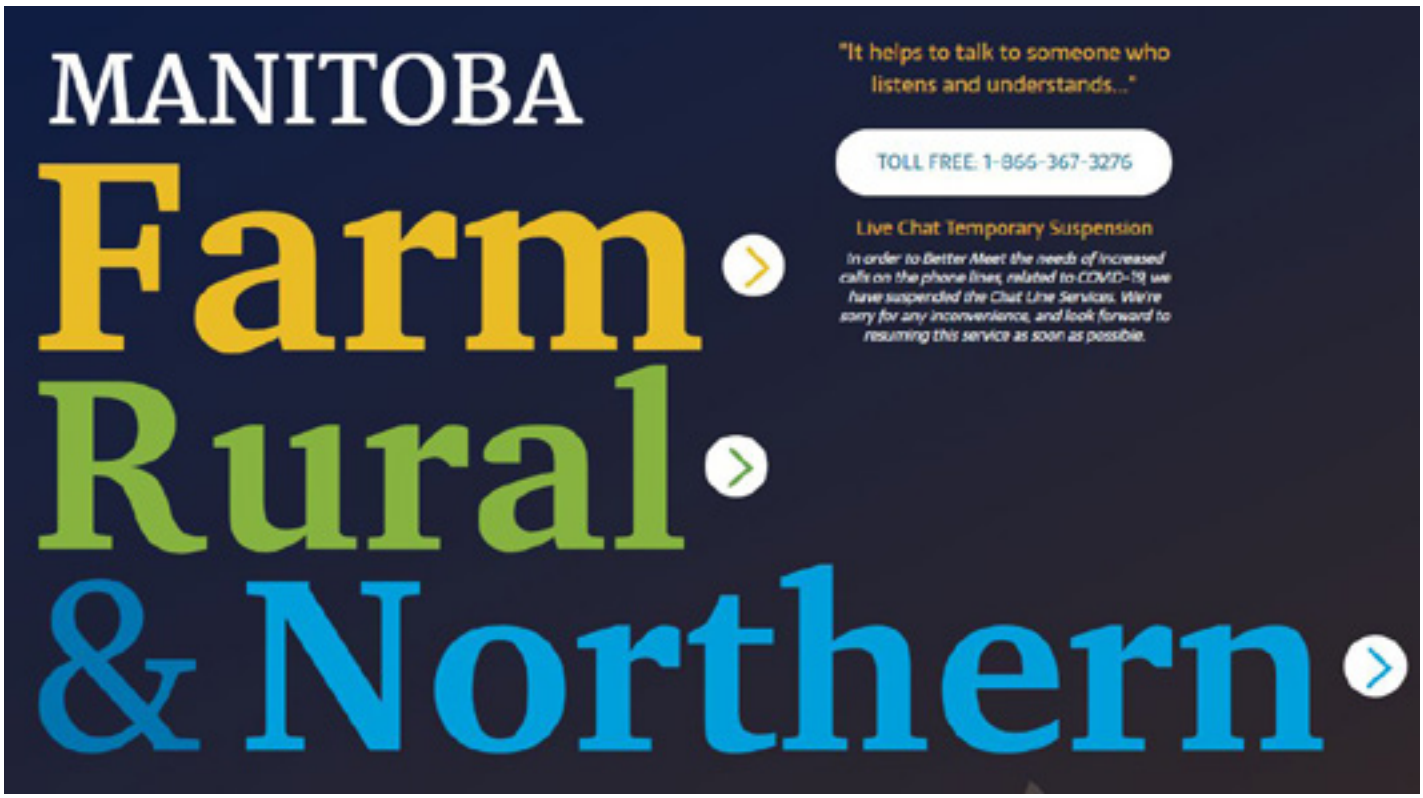
In mid-2005, I was on a motorcycle trip with my brother. I had been medication-free for a few months and was functioning quite well, or so I thought. On the last day of the trip, as we were nearing home, I witnessed him crash his bike. That very morning, before we hit the road, we had made the decision to sell the farm. Unfortunately, the relief brought on by that decision was short-lived. After he had his accident, he fell into a coma, and I needed to take over his portion of the work. Life began to overwhelm me.

Shortly following my brother's accident, and shortly before selling the farm, my wife and I decided I should try talk therapy. I had a session with a psychologist who was not impressed that I was planning to sell the family farm, and at the end of the appointment, he said I needed to go back on meds, because I would not be able to afford his services. After that, I visited a community mental health worker who really tried to assist, but after two sessions, she felt incapable of helping me. So, I went back on meds.

I was always convinced that, should we be able to sell the farm, my depression and anxiety would also end. In 2007, when we were able to sell the farm and move on, it dawned on me that was not the case.

To change your life, change your approach

As part of the farm wind down and as an opportunity to enhance my conflict management work, I applied to the Manitoba Farm, Rural & Northern Support Services line as a volunteer. In retrospect, and entirely unintentionally, that was when the discovery process truly began, and I started to understand how best to manage by mental health.



Help may arrive when and where you least expect it. For Friesen, counselling others became an outlet to explore his own issues.

First and foremost, through the training, I learned so much about mental health and how that related to my situation. Second, I was contracted to facilitate depression workshops for men, which added to my knowledge through research and through meeting and talking to others.

In preparing for my new role, I felt the need to talk to my wife and kids about my depression. I had always thought that I was doing a good job of hiding it but found out rather differently. My wife expressed how I had changed into a different person over time – no longer the person she had married. My kids talked about crying themselves to sleep because of their concern for me and our family's financial issues. I had no idea, and perhaps it was better at the time. I suspect that, if I had known earlier, the guilt might well have pushed me over the edge.

Was I suicidal at any time? No, but I certainly had thoughts of dying, because in my twisted way of thinking, there would be some benefit. I could relieve my mental anguish, my wife and kids would benefit financially, and the world would be better off without me. I was not afraid of dying; I was afraid of living.

In 2015, I received a call that shook me to the core: the wife of my long-time friend, and mother of their children, had died by suicide. At her funeral, the family shared how they had gained a much better understanding of mental illness. The family was very clear that she had put up a strong fight and had lost, similar to someone who battles cancer but ultimately succumbs to the disease. I had many emotions running through me. I felt encouraged knowing that I and many others had nothing to be ashamed or embarrassed about. And I felt a tinge of envy that she had escaped her pain. But I also felt an incredible fear – afraid that some morning I might wake up and just not be able to face another day.

My recovery has been far from linear. At the outset of sharing this experience, I used the word 'labyrinth.' Going back to the dictionary, 'labyrinth' is defined as, "a place with a lot of crisscrossing or complicated passages, tunnels or paths in which it would be easy to become lost." I still live in that labyrinth. But because of a deeper understanding and utilizing what I have learned, it is much easier to navigate without becoming totally lost.

Managing stress is a good first step

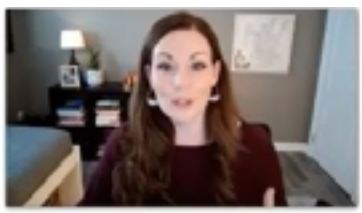
In her presentation, Robyne Hanley-Dafoe touched on the symptoms of burn-out, including feelings of energy depletion and exhaustion, increased mental distance from one's job, feelings of negativity and reduced professional efficacy. She also provided some good techniques for managing these conditions, including letting go of guilt, acknowledging your fears and working toward total mental and physical wellness – whatever that means for you. And I can tell you from experience that taking this seriously is key not only for your own well-being but also for the management of your farm.

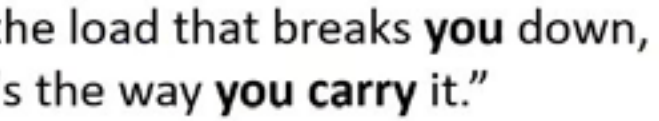
Stress impacts us in various ways. It can be quite insidious and can affect us physically, emotionally, mentally and socially. Over time, we may notice subtle changes occurring and tend to ignore these hints. As stress builds or continues over an extended period, the impacts on us increase, and our behaviours change. It is important not to ignore these signs.

Some time ago, my family noticed that I was headed off the rails again and made it clear that I needed to seek additional help. I found myself going to a naturopath appointment, which turned out to be pleasantly surprising, despite my initial cynicism. For the first time ever, someone was able to connect the dots for me. There was no instant fix that day. Rather, it was just the clear understanding of the nuances of my mental health that gave me the extra push I needed to continue my journey in a new way.

Through awareness, acceptance and an effort to be more intentional about my recovery, I can now weather fluctuations better by sticking with the things that help when I experience a bad spell. While I still have bouts of anxiety, or times when my mood is subdued, I can rest assured that the moment will not last forever, and that gives me the ability to experience life as best as possible.

As you become more cognizant of your own mental health and the mental health of those around you – your family, colleagues and others – remember that my experience is not unique in principle. You may be going through something similar. And if you are, there is no better time than right now to nip it in the bud. It may save your life or someone else's. Having the courage to address my own issues likely saved mine, and because of that, my wife still has a husband, and my kids still have a father today. ■





Robyne Hanley–Dafoe's five core traits of resiliency are: belonging, perspective, acceptance, hope and humour. For Friesen, these are essential to managing stress.

Strengthening ASF detection in Canada

Geoff Geddes

Editor's note: The following piece was written for Swine Innovation Porc. For more information, contact Leslie Walsh at lwalsh@swineinnovationporc.ca.

If we diagnosed African Swine Fever (ASF) like we do the common cold, you could just look for pigs that are sneezing or blowing their nose. Unfortunately, ASF is much harder to detect and far more lethal for the hog industry.

In light of that reality, the timing was perfect for a presentation on ASF diagnosis during the 2021 Banff Pork Seminar. The talk was one of six that comprised an ASF webinar presented by Swine Innovation Porc (SIP) called, "African Swine Fever: How is Canada Getting Prepared?"

Using their virtual platform, swine sector experts offered a glimpse of what the pork industry is doing to prevent and prepare for an outbreak of ASF in Canada. Moderated by Stewart Cressman, Chair, SIP, the session included information on ASF research priorities in Canada, risk mitigation, emergency depopulation preparedness, research activities in the U.S. and Canada's efforts to face the threat of ASF.

"My objective is to provide a brief overview of our efforts to evaluate alternative sample types for ASF diagnosis," said Aruna Ambagala, a research scientist with the Canadian Food Inspection Agency's (CFIA) National Centre for Foreign Animal Disease (NCFAD) in Winnipeg. Ambagala is head of the Mammalian Disease Unit and the World Organisation for Animal Health (OIE) Reference Lab for Classical Swine Fever (CSF) at the NCFAD.

"Because of the non-specific clinical signs, laboratory diagnosis is essential for ASF in Canada and the U.S.," said Ambagala. "We have state-of-the-art diagnostics, but we continue to work on improving them as we go."

How ASF is detected in carcasses

In regard to ASF diagnosis, there are two approaches: detecting the agent, which is the virus, and looking at the antibodies to the virus.

"With the agent, we are examining the genomic material of ASF, which you can do using a real-time PCR screening test available at NCFAD and at labs that are part of the Canadian Animal Health Surveillance Network," said Ambagala.

The Canadian Animal Health Surveillance Network (CAHSN) is a network of federal, provincial and university animal health laboratories across Canada.

Stewart Cressman opened the presentation, featuring Aruna Ambagala and other SIP-supported researchers.

During the Banff Pork Seminar in January 2020, Klaus Depner presented on Germany's campaign to stay ASF-free. Despite their best efforts, since September 2020, more than 500 ASF cases have been discovered in wild boar carcasses near Germany's border with Poland.

Used to detect ongoing outbreaks, this test spots the presence of ASF in an animal and takes two to four hours once the samples are received in the lab. The initial result will be confirmed within 24 hours by sequencing, followed by virus isolation and whole genome sequencing, all at NCFAD. Virus isolation can take up to 15 days to complete.

"The other method of ASF diagnosis is scrutinizing the antibodies for evidence of past exposure to the virus," said Ambagala. "You can see the antibodies for months or years afterwards in the serum samples through an enzyme-linked immunosorbent assay test at NCFAD."

The enzyme-linked immunosorbent assay (ELISA) is an immunological assay commonly used to measure antibodies, antigens, proteins and glycoproteins in biological samples. NCFAD can handle a large number of samples, and because the specificity of the test is not optimal, they must perform complementary tests to augment it. Samples currently accepted for these additional tests can be whole blood and serum samples.

"If a pig is dead, we request a full post-mortem and submit tissue samples such as tonsils, spleen, liver, kidney or lung," said Ambagala. "The most important sample for detection of ASF and other viruses like CSF are the tonsils, and bone marrow is requested if the carcass is decomposed."

Test limitations and work-arounds

Of course, there are limitations to these sampling efforts. Early detection of ASF is critical, and diagnosis based on clinical signs is difficult. This is especially true during initial stages of the infection, when symptoms may not be an obvious indicator of the virus.

"In light of the limitations, we need to maintain some sort of surveillance program. This can be problematic, as individual sampling is quite labour-intensive and costly when you need to handle individual animals or conduct a full post-mortem to collect samples," said Ambagala.

To overcome the cost and time hurdles, researchers are exploring alternative sample types for two different scenarios: groups of live animals and herds that have a high mortality rate.

"For group samples, we are looking at oral fluids and processing fluids," said Ambagala. "In the case of samples from carcasses, we need ones that can be collected quickly and safely from dead pigs without a full post-mortem."

All samples must be validated and compared to the 'gold standard' sampling

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The Canadian Food Inspection Agency's (CFIA) National Centre for Foreign Animal Disease (NCFAD) in Winnipeg, where Ambagala's team operates.

types that include whole blood, tonsils and spleen. To do so, scientists examine the viral load of the samples as determined by real-time PCR and virus isolation.

Liquid gold: oral fluids test best

What makes oral fluids attractive for sampling?

"Oral fluids are a mixture of saliva coming from major and minor salivary glands, so they are a very rich sample that we can test for both pathogens and antibodies," said Ambagala. "These fluids have also been proven to detect Porcine Reproductive and Respiratory Syndrome [PRRS], Porcine Circovirus type 2 [PCV2] and Swine Influenza Virus [SIV]. Multiple research projects confirm that the ASF genome and antibodies can be detected in oral fluids upon infection."

Additionally, oral fluids are an easy sample to collect. Pigs are naturally attracted to a hanging rope, and once they chew on it for 30 minutes, the sample can be taken. Of particular interest to both farmers and consumers, collection of oral fluids is non-invasive, humane and feasible to do on-farm.

Validation of oral fluids is necessary

Like other sample types, oral fluid testing must be validated to confirm its efficacy. NCFAD, in collaboration with the Plum Island Animal Disease Center of New York, is performing experimental inoculations to show that ASF can be detected in oral fluids early enough to be used for surveillance.

"In a preliminary experiment at NCFAD, we inoculated four pigs in a pen with ASF and found we could identify the oral fluid before the animals showed real clinical signs," said Ambagala. "We then repeated that experiment on a larger scale with two tests at NCFAD and two at Plum Island. We used ASFV Georgia – the strain of the virus currently circulating in Europe and Asia – at NCFAD, and we used Malta/78 ASFV – a moderately virulent strain – at Plum Island."

The researchers then introduced an infected pig into a larger pen of 24 pigs and collected daily samples from all animals, observing how the virus spread in the pen and how early they could detect it in oral fluids. The results confirmed the power and potential of oral fluids in relation to ASF.

Ambagala's team prefers oral fluids over other sampling mediums.

"The specific purpose of the oral fluid would be for early detection of ASF in commercial herds and, if all goes well, could be considered for claiming disease freedom in compartments during an outbreak," said Ambagala.

Going forward, the plan is to conduct field evaluations on oral fluids in Vietnam, and the researchers are currently running some additional evaluations in the lab.

"We are also looking in more detail at the diagnostic sensitivity, specificity and measurement of uncertainty of the oral fluid samples, and we are trying different instrumentation and technicians. Because these samples can be tricky to work with, we are planning to conduct a reproducibility experiment where we test the same oral fluid samples at two labs to ensure our detection is accurate," said Ambagala.

At the same time, the researchers are collaborating with Iowa State University to improve the sensitivity of ASF detection in oral fluids. They will soon be starting another project with Kansas State University that evaluates commercial PCR kits for spotting ASF in those fluids.

Additional detection method options

As a second option for detecting ASF, researchers are examining processing fluid, which is the serosanquinous fluid collected at routine castration and tail docking between the ages of four and 14 days. Serosanguinous fluids are composed of clotted or diluted red blood cells mixed with serum.

"With processing fluids, we are targeting breeding herds and suckling pigs – two groups that are not well suited to oral fluid testing, because they won't go after the rope that is used to collect oral fluids," said Ambagala. "If we can target these groups with this sample type, we will expand our ability to screen our swine herds, doing so with much less strain

on producer finances and human resources."

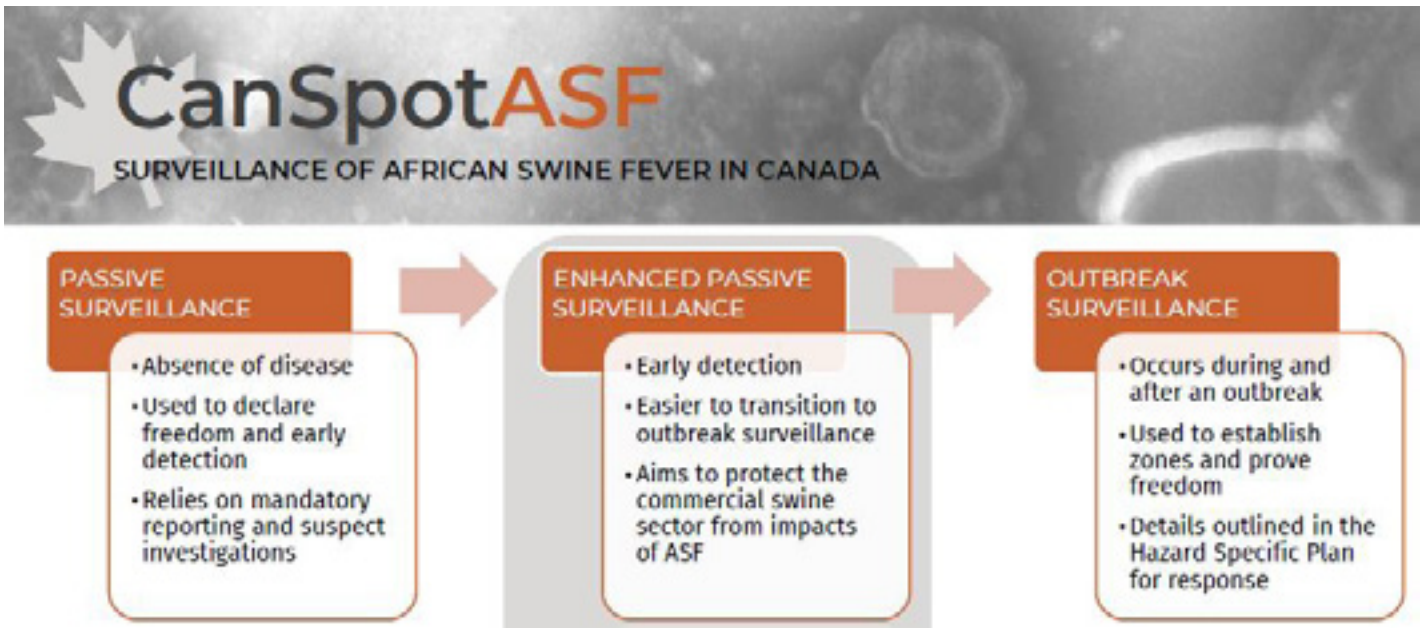
A third alternative to routine post-mortem sample types is the use of superficial lymph nodes. This sample can be easily collected with little to no bleeding and minimal environmental contamination, takes just one or two minutes to collect and is readily accessible. Initial testing with lymph nodes shows great promise for detection of ASF, and scientists plan to expand this work.

As detection improves, so does industry resiliency

Detecting ASF is one piece of the puzzle that should help Canada put up a strong defense against the virus. Engaging stakeholders from across the value chain and continuing to share information is the industry's best chance at successfully remaining ASF-free.

As Stewart Cressman observed following the presentation, this project "highlights the collaboration that exists on these files across international borders."

ASF detection may never be as simple as diagnosing the common cold, but if it can be done cheaply, easily and in a humane manner, that is nothing to sneeze at. ■



Disease detection is a critical part of surveillance. In May 2020, CanSpotASF was launched as a national ASF surveillance initiative, with the cooperation of farmers, assemblers, transporters, packers and labs.

Assessing piglet physiological changes in transport

Hannah Golightly

Editor's note: Hannah Golightly is a PhD candidate in the Department of Population Medicine at the University of Guelph. Golightly's research was featured as part of the 2021 Banff Pork Seminar poster session.

Introduction

Weaned piglets are often transported from the sow farm to standalone nursery sites to improve biosecurity within the flow, improve piglet health and return economic benefits. Although this is quite commonly done, knowledge gaps remain surrounding the effects of commercial transport on weaned piglet well-being, specifically in the areas of duration of transport, trailer type, and providing feed and water in transit.

The objective of our project was to assess changes in piglet physiology under different commercial transport conditions. More specifically, looking at the effect of duration.

Methodology

We took an approach looking at two groups of piglets: a short duration group and a long duration group, transporting for less than three hours or greater than 30 hours, respectively. The two systems we worked with used different trailers and had different weaning timelines. The short duration group used a flat-deck trailer and weaned the morning of transport. The long duration group used a potbelly trailer and weaned multiple days prior to transport.

About 24 hours before transport, we went to the sow farms to examine the piglets. They were weighed, had their blood sampled and were given lesion and gait scores. During transport, we monitored temperature and relative humidity in transit, both in the trailer compartment area and outside of the trailer. After arriving at the nursery sites, the same pre-transport tests were performed, which were repeated a third time approximately 72 hours later.

Between June and August 2019, we collected data on eight replicates (four per duration group), which accounted for 11,434 piglets transported in total. We sampled 200 piglets from the short duration group and 240 from the long duration group, which make up the data for this study.

Results and discussion

Figure 1 shows the odds of lesions or lameness for short duration group piglets compared to long duration group piglets at each timepoint. Before transport, we can see that short duration group piglets had significantly decreased odds of having a skin, ear or tail lesion present, compared to long duration group piglets. These are lesions and lameness of any severity being present, compared to no lesions being present at all.

By the time the piglets arrived at their nursery barns, we saw that the short duration group piglets had increased odds of having a gait abnormality present compared to long duration piglets. And by 72 hours after arrival, we saw that short duration group piglets had increased odds of having any ear or tail lesions present.

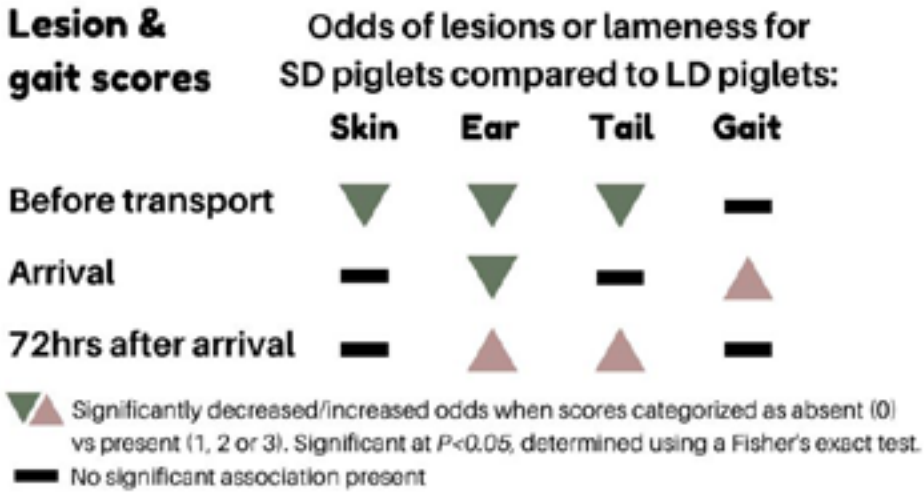


Figure 1: Lesion and gait scores before transport, immediately after transport and 72 hours after transport.

Looking at body weight, *Figure 2* (on the following page) shows how individual piglet weights changed over two different time periods: the first graph shows the transport period (the difference between arrival weight and pre-transport weight), and the second graph shows the individual weight change over the study period (the

CONTINUED ON PAGE 32

Three days following transport, piglets appeared to regain any weight lost during transport.

difference from the 72-hour weight after transport to the pre-transport weight).

We saw considerable variation between piglets from different duration groups, as well as within the same duration groups. Looking at the weights listed below the graphs, piglets from the short duration group weighed significantly more than piglets that underwent long duration transport. However, by 72 hours after arrival, there was no longer a significant difference between the two groups' weights after adjusting for pre-transport weight and sex.

Comparing the blood parameter results in *Figure 3* (on the following page), we found that there was a mild but statistically significant increase in the red blood cell counts observed in the long duration piglets compared to the short duration piglets, which may suggest increased levels of dehydration in the long duration piglets.

Considering indicators of physiological stress, after adjusting for pre-transport value, we saw that short duration piglets had significantly increased serum cortisol, white blood cell counts and neutrophil-to-lymphocyte ratios present, which may indicate that they underwent greater physiological stress over this experience compared to long duration group piglets.

Looking at indicators of muscle strain, we found significantly elevated AST and CK levels in the short duration group pig-

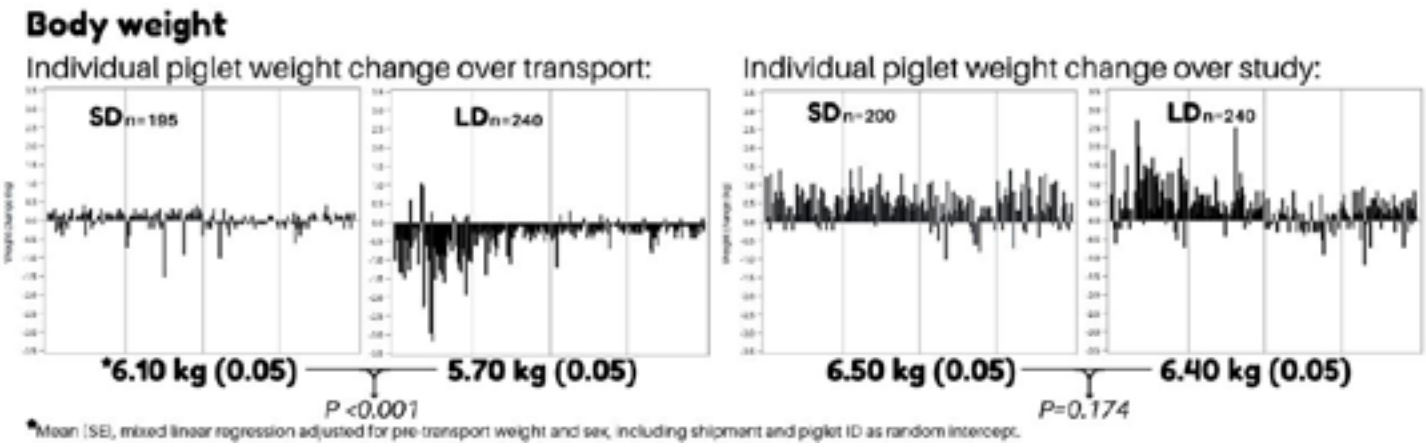


Figure 2: Lesion and gait scores before transport, immediately after transport and 72 hours after transport.

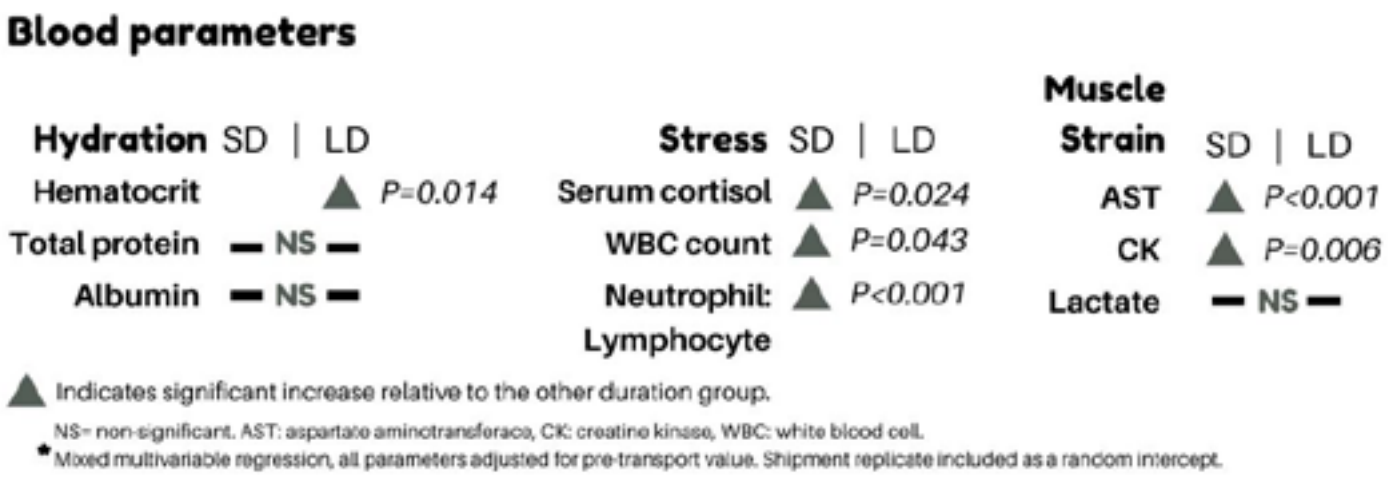


Figure 3: Hydration, stress and muscle strain determined from blood samples.

lets compared to the long duration group piglets, which may suggest increased muscle strain occurring over the transport period for the short duration piglets.

Conclusions

Differences in weaning time relative to transport significantly affected the lesion scores we observed and help explain the pattern and changes in associations over time.

Looking at weight loss, although there was a difference over the transport period, there was no longer any difference in weight between the two groups 72 hours after arrival, suggesting that any weight loss incurred over the transport period was quickly regained by the long duration group piglets.

Finally, for the blood parameters, while we did find differences between the two groups, all values were within normal range for this age group, so the biological significance of the differences observed between the two groups remains unclear, though we hope to clarify this with further analysis of the behavioural data we collected alongside physiological data.

Acknowledgements

I would like to thank our collaborators, summer students and especially our producer participants and project funding sources for their support of this project. ■

Story idea?
Press release?
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Prevalence of pig coronaviruses in manure pits

Julian Montoya Lopez

Editor's note: Julian Montoya Lopez is a Master's student in the Department of Veterinary Population Medicine at the University of Minnesota. Lopez's research was featured as part of the 2021 Banff Pork Seminar poster session.

Company	Boar stud	Finishing	Nursery	Sow farm	Wean to finish	Total
A	1	27	2	108	49	187
B	2	6		17		25
C		50	8			58
D				24		24
E				6		6
Total	3	83	10	155	49	300

Table 1: Number and types of farms participating in the study.

Introduction

Viruses such as Porcine Reproductive and Respiratory Syndrome (PRRS), Porcine Epidemic Diarrhea (PED), Porcine Delta coronavirus (PDCoV) and Transmissible Gastroenteritis (TGE) continue to be present in the swine industry, generating significant financial losses. Infected pigs shed viral particles into the environment, which can exit the barn either through exhaust fans or fall into manure pits, where they may remain until pumped out.

PRRS outbreaks in sow farms have a seasonal pattern, with most cases occurring during the fall and winter, a time when manure pumping activities are performed by most producers. It is not understood whether PRRS outbreaks and manure pumping are related.

As a starting point to our research, we decided to investigate whether these pathogens are present in manure pits, as a way to estimate their barn-level prevalence.

Methodology

This cross-sectional study was conducted in the midwestern U.S. Since the manure pit prevalence of PRRS, PED, PDCoV and TGE is unknown, a default barn-level prevalence of 50 per cent was used for sample size calculation. Based on this calculation, a total of 385 pig barns were needed to estimate herd level prevalence for these viruses (*Table 1*).

Five companies were conveniently selected to participate in this study. Samples from four companies were originally collected for nutrient analysis and used for the study. Additionally, for one company, we directly sampled manure pits.

Samples were submitted for RT-PCR and virus isolation. Data was subjected to a univariable logistic regression model to determine the relationship between the log odds of being positive for each virus and sow farm origin status. Then, a multivariate logistic regression model was performed to determine the relationship between the log odds of being positive for each virus, sow farm origin status and type of farm. No statistically significant relationships were found.

PED, PRRS and PDCoV were found in hog manure pits at different levels.

Results and discussion

A total of 300 manure samples were collected and tested (*Table 2*, on the following page). PED was detected on 48 farms, PRRS on 27 farms and PDCoV on 19 farms, while TGE was not detected on any farms.

No viable virus was found in any of the analyzed samples, nor were samples sequenced. No statistically significant associations between the outcome and factors were detected in the model.

Conclusions

While results from this study confirm the presence of PED, PRRS and PDCoV in manure pits, the status of pigs in these barns was unknown, which opens an opportunity for a follow-up study.

CONTINUED ON PAGE 36

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Company	Boar stud	Finishing	Nursery	Sow farm	Wean to finish	Total
A	0	0	1	10	5	16
B	0	0		0		0
C		10	1			11
D				0		0
E				0		0
Total	0	10	2	10	5	27

A

Company	Boar stud	Finishing	Nursery	Sow farm	Wean to finish	Total
A	0	2	0	4	12	18
B	0	0		0		0
C		25	4			29
D				1		1
E				0		0
Total	0	27	4	5	12	48

B

Company	Boar stud	Finishing	Nursery	Sow farm	Wean to finish	Total
A	0	1	0	4	3	8
B	0	0		0		0
C		9	2			11
D				0		0
E				0		0
Total	0	10	2	4	3	19

C

Table 2: PRRS-positive farms (A), PED-positive farms (B) and PDCoV-positive farms (C).

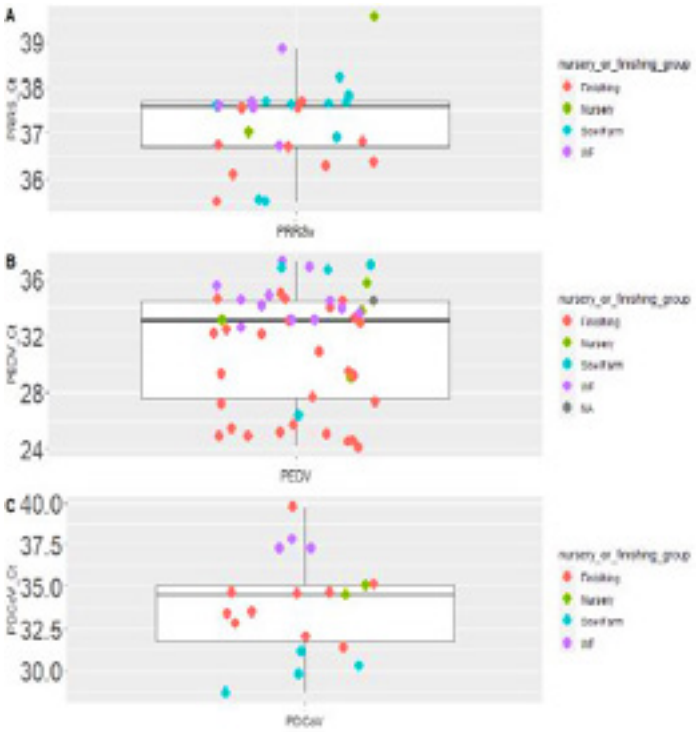


Figure 1: Boxplot with Ct values for PRRS-positive farms (A), PED-positive farms (B) and PDCoV-positive farms (C).

Viability of the virus was not proven; however, sample freeze-thaw cycles and viral dilution may have played a role into these findings. Therefore, further investigation into virus viability is warranted.

PRRS Ct values tended to be higher compared to PED and PDCoV (*Figure 1*). These differences may be explained by the fact that the latter viruses replicate in the intestinal lining, leading to a large number of viral particles being shed into the environment.

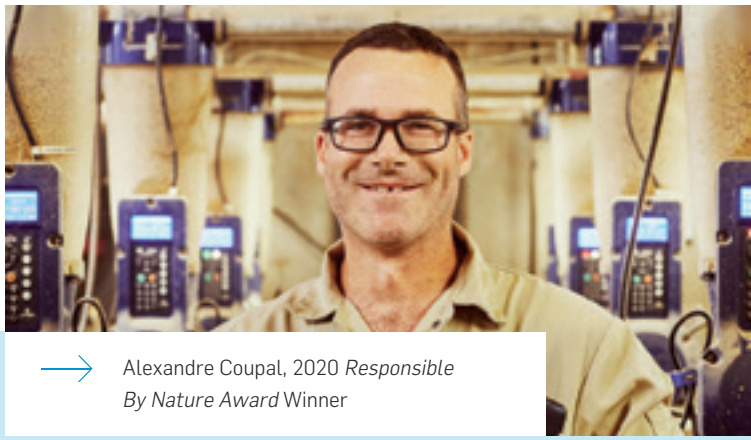
This study raises awareness of the presence of viral genetic material and concentration of high-impact pathogens in manure pits. More studies need to be conducted to further understand the implications of these findings, especially when conducting manure pumping and spreading activities.

Acknowledgements

I would like to thank the University of Minnesota Signature Program, participating production companies and swine practitioners for their support of this project. ■

Les Éleveurs de porcs du Québec

Prestigious *Responsible By Nature Award* Given to Ferme A. Coupal et fils



Alexandre Coupal, 2020 *Responsible By Nature Award* Winner

Alexandre Coupal, owner of Ferme A. Coupal et fils, is this year's recipient of the *Responsible by Nature Award*.

Through the many initiatives that were undertaken on his farm, Alexandre Coupal has demonstrated his commitment to upholding the socially responsible approach to farming the Éleveurs de porcs du Québec has encouraged since 2014.

Being at the forefront

For Alexandre Coupal, being innovative and at the forefront are in his DNA. In 2014, Ferme A. Coupal et fils was among the first farms in Quebec to convert its facilities to animal welfare standards in order to house pregnant sows in groups.

"I wouldn't think of going back to the way things were before considering how much management quality and the environment for the sows has improved. The animals are now so calm," he said. "For example, sows are accustomed to having humans nearby and in being moved around." So now, when they open the gate to a pen to let a pig in or out, there's no panic at all in the group. The animals are used to being free.

Farming is above all giving of oneself

Alexandre Coupal is very committed to his community. He donates meat to the Fabrique de Saint-Bernard-de-Michaudville and to other organizations that hold raffles to raise funds. Above and beyond donations, he believes it's important to volunteer by giving a helping hand to the community and to those in need. "For me, the most important thing you can give when you volunteer is your time," he said. "That's a belief I try instill in my three kids and why I sometimes take them along with me in fulfilling my commitments to the community."

> **"You have to be open to change and be able to adapt to new situations."**
>
> Alexandre Coupal

To learn more about this year's winner, visit leseleveursdeporcsduquebec.com and go to the Actualités section to read the full article.

Accelerating genetic gain to advance the swine industry

Dan Hamilton

Editor's note: Dan Hamilton is the product performance director at PIC. He can be contacted at daniel.hamilton@genusplc.com.

Fast, efficient growth. Robustness. Total carcass value. These attributes are more relevant than ever, especially as hog producers strive to increase growing pig performance with fewer inputs. One way to improve these is through advancements in terminal sire genetics.

The challenge? Genetic improvement takes time. But what if we could further accelerate the realization of these economically relevant traits, delivering pigs with more profit potential faster?

PIC's goal is to deliver faster genetic progress and shorten the time it takes for producers to realize genetic gains. During the 2021 Banff Pork Seminar, PIC's work in terminal sire genetics was presented for attendees.

Driving genetic improvement

Four key pillars drive accelerated gain at PIC:

Selection based on commercial profit – PIC's genetic program regularly measures more than 20 traits and combines those traits based on their economic value into a single estimate of overall genetic merit. This allows PIC to select animals most economically suited for producers.

Selection intensity – PIC has increased population sizes across the company's Elite Farm system. In fact, some populations are as much as 10 times larger than just 10 years ago. Access to a larger pool of animals allows for selecting the highest performers in economically relevant traits.

Meaningful data capture – It is imperative that pigs, selected for the traits above, perform at the commercial level. PIC's GNXbred program tests PIC genetics in a commercial setting to ensure robustness and realization of genetic improvement. The addition of new traits and overall expansion of this program is a key priority for PIC's genetic development program.

Cutting-edge science – Full implementation of Relationship-Based Genomic Selection in 2014 has accelerated genetic gain by 35 per cent. With more scientific developments on the horizon, producers can expect more gains in their future.

Measuring genetic improvement

Genetic trends at PIC Elite Farms show improvement in key traits like weight per day of age, feed conversion ratios and wean-to-finish mortality rates.

From 2016 to 2020, weight per day of age has shown a genetic trend improvement of more than 27 grams. Feed conversion ratio improved by 0.08 per cent and wean-to-finish mortality improved by 0.08 per cent.[1]

These trends are translating into meaningful genetic gains for producers and their operations.

CONTINUED ON PAGE 40

Dan Hamilton presented during the Banff Pork Seminar's off-day, between the two main programming days.

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Delivering economic advantages

Years of genetic improvement mean nothing unless they lead to meaningful economic value for producers in a commercial setting.

PIC recently conducted several comparative trials in commercial settings, which confirmed PIC's sire lines hold tangible economic advantages over competitor boars (*Figure 1*).

Across multiple trials, PIC®800 had an economic advantage ranging from $3.07 to $6.88 per pig placed, and PIC®337 showed an economic advantage of $0.82 to $12.02 per pig placed compared to competitors.[2,3]

Research-proven performance

Two commercial trials conducted in 2020 compared PIC sire lines to industry competitors, evaluating characteristics that drive overall economic value.

One research trial compared growth rates of PIC®800 (Duroc) and PIC®337 (white line terminal sire) to two competitor sires – Competitor A (Duroc) and Competitor B (white line terminal sire).[4] PIC®800 had significantly faster growth rates at 1.10 kilograms per day, with PIC®337 showing 1.09 kilograms per day growth rate. Competitors A and B lagged at 1.04 and 1.08 kilograms per day, respectively.

PIC®337 also had the advantage with the lowest mortality rate and highest carcass yield percentage. Competitor B had significantly higher mortality rates and the lowest dressing percentage but did have a slight advantage in percent lean. PIC®800 and competitor A were intermediate in all categories.

Improved growth rate coupled with excellent feed efficiency and the competitors' mortality disadvantages resulted in an economic advantage for both PIC®800 and PIC®337 sire lines, including greater net margins above feed and housing costs per pig placed ($74.65 and $76.07, respectively) compared to competitors A and B ($67.77 and $69.83, respectively).[2]

A second trial comparing the same PIC sire lines to two different Duroc competitors showed similar results.[5] Again, PIC®800 and PIC®337 had significant average daily gain advantages over competitors A and B (1.032, 1.030, 1.003 and 0.995 kilograms per day, respectively).

PIC®337 was the most feed efficient line. PIC®800 was the fastest-growing line, had more full-value pigs, was competitive on feed efficiency and held a carcass lean advantage over all sires.

Again, growth rate advantages resulted in larger economic advantages. PIC®800 and PIC®337 sire lines showed greater net margins above feed and housing costs per pig placed ($65.26 and $65.83, respectively) compared to competitors A and B ($60.27 and $61.19, respectively).[2]

This improvement in terminal sire genetics is beneficial for the producer and the consumer, resulting in a more efficient pork production chain, better pork quality and higher customer satisfaction. ■

References

1 Source: PIC NA Elite Farm Genetic Trends; Average of PIC®327, PIC®337 and PIC®800
2 Reference: ES122, ES126, ES129, ES133, ES142, ES144 and ES150.
3 USD to CAD exchange rate: $1.31.
4 Reference: ES144
5 Reference: ES150

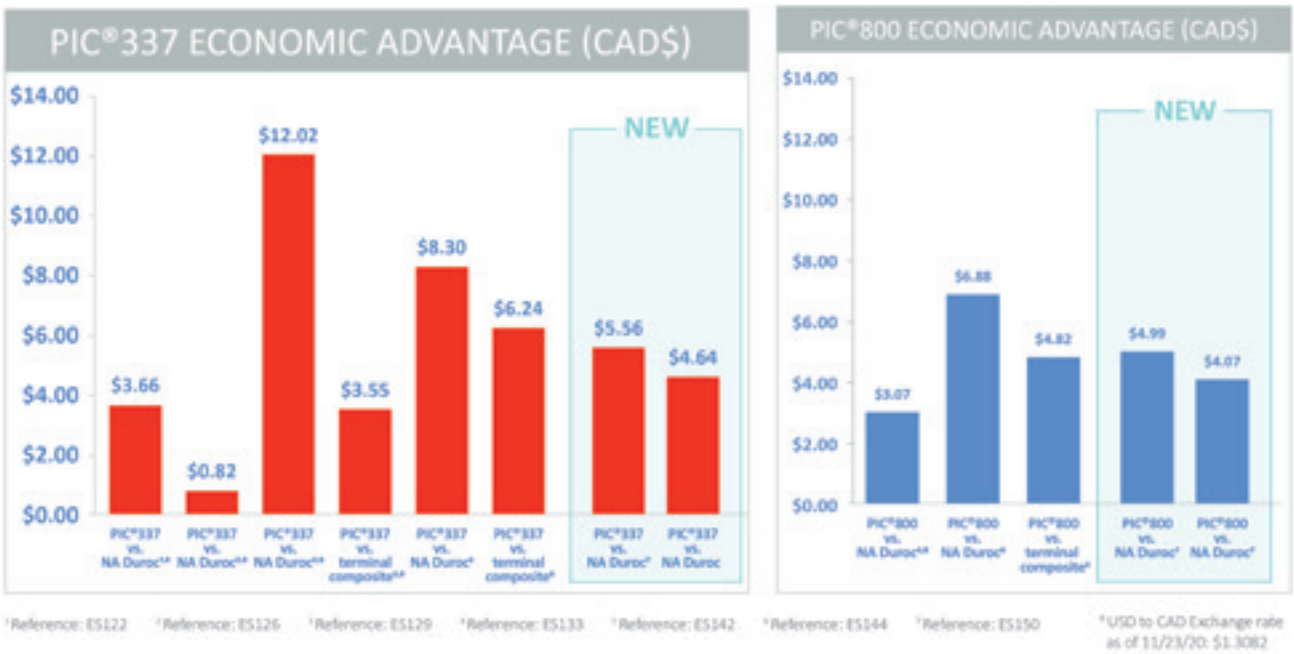

Figure 1: Trials were conducted using Camborough® sows. All pigs were gestated, farrowed and grown together in contemporary groups. Facilities, nutrition and management were constant within each trial to ensure accuracy.

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Meet the 2021 Banff Pork Seminar award winners

Editor's note: The F.X Aherne Prize recognizes individuals who have developed either original solutions to pork production challenges or creative uses of known technology. The prize is named for the late Frank Aherne, a professor at the University of Alberta, who was a major force for science-based progress in the Canadian pork industry.

The R.O. Ball Young Scientist Award recognizes graduate students who provide a best overall combination of good and relevant science, well-written abstract and excellent presentation. The award is named for Ron Ball, a longtime researcher and former Banff Pork Seminar director.

Power washer bracelet improves safety

The 2021 F.X. Aherne Prize was awarded to Martin Gosselin of Saint-Isidore, Quebec for his invention of a safety bracelet grip control for power washers.

Power washers require enormous force, and the repetitive effort required to control them can lead to a range of occupational health issues. This invention reduces strain on the wrists and forearms of barn workers, favouring overall safer use.

Martin Gosselin's safety bracelet for power washers

Martin Gosselin's safety bracelet for power washers

Gosselin works with Agri-Marche, a Quebec-based feed company, and came up with the idea after observing devices used in the watercraft, snowmobile and cycling industries. Gosselin designed a grip that allows the worker to hold and fully control the trigger without undue strain. It also allows for easy shutdown of the equipment in the event of an emergency.

"We use cleaning machines with 3,000 pounds of pressure," said Gosselin. "Controlling the power washer wand and gripping the trigger requires a great deal of hand and forearm strength. Over time, this constant strain can cause short-term injuries and long-term conditions like carpal tunnel syndrome and tendonitis."

A common but unrecommended technique for easing strain is to lock power washer triggers using tape or a tie wrap. This seemingly effective practice can be dangerous in the event a worker falls or drops the wand.

Gosselin's bracelet partly borrows its concept from the key to a personal watercraft or snowmobile attached to the user's wrist. The user maintains the starter key with continued ability to immediately shut down the equipment if

CONTINUED ON PAGE 44

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control is lost. Gosselin also cites cyclists' pant clips as inspiration.

The prototype used a chain at one end of the device attached to a hook-and-loop cat collar going around the wrist, with a metal hose clamp as a hold-down for the gun trigger. After a trial period of nearly four months by several Agri-Marche workers, the bracelet now has a thicker wrist strap and stronger chain.

Student science winners announced

The first prize of the 2021 R.O. Ball Young Scientist Award was given to Mariia Tokareva of the University of

Mariia Tokareva

Joaquin Sanchez-Zannatta

Saskatchewan. Her work, "The impact of providing periodic exercise on the welfare of stall-housed gestating sows," was published in the Fall 2020 edition of the Canadian Hog Journal.

Tokareva's research suggests a direct relationship between the cost of conversion to group sow housing and return on investment. Producers would be encouraged to make the transition to groups sooner than later. This way, the conversion process becomes cheaper, as the return on investment is better. The lower (better) the payback, the more incentive producers have to spend money on their facilities rather than additional labour.

For her efforts, Tokareva received a $500 cheque and a plaque.

The second prize of the 2021 R.O. Ball Young Scientist Award was given to Joaquin Sanchez-Zannatta of the University of Alberta for his paper, "Feeding barley instead of wheat grain can achieve similar growth performance in weaned pigs."

Sanchez-Zannatta's research suggests hulled or hull-less barley does not reduce growth performance of weaned pigs, and 'steam-explosion' of hulled barley does not increase feed intake or weight gain but results in lower feed efficiency. As such, hulled or hull-less barley can replace wheat in diets for weaned pigs without affecting growth performance provided the diets are properly balanced.

For his efforts, Sanchez-Zannatta received a $250 cheque and a plaque. ■

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