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PRAIRIE SWINE CENTRE

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Moving forward with improved sow housing: Current progress and prospects

Jen-Yun Chou, Ph.D.
Prairie Swine Centre

"I'm the new Jen, the name doesn't even change!" joked Jen-Yun Chou, the new ethology and welfare research scientist at Prairie Swine Centre, as she introduced herself to the crowd at the 2024 PSC Producer Meetings. Jen started her work at PSC in February of this year and succeeds Jennifer Brown who retired last year. As the Producer Meetings was the first opportunity for Jen to introduce herself and her work to Canadian producers, she gave an overview of her previous research focus and travels through the pig world, including research on sow housing and environmental enrichment.

Jen started her presentation with a definition of animal welfare based on the five domains model, which shows that good animal welfare is the culmination of a good environment, good nutrition, good health, and the ability to perform natural behaviours, all of which result in an animal with a good mental state. The mental state is sometimes overlooked but is very important as it connects all the basic needs of the animal. Jen was born and raised in Taiwan, a small island with a large human population. The pork industry is the number one

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Seek and you shall find; The value of postmortem, in pigs?

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Why should we do post-mortem examinations in pigs? That's the question Jeff Bergermann, Veterinary Services Manager at Zoetis Canada, posed at the start of his presentation to participants of the 2024 PSC Producer Meetings. Jeff, who owns a small herd of cattle, showed pictures of a dead calf that looked completely normal on the outside. However, once he had cut open the calf, it turned out that its heart had been developing outside its chest, instead being in the neck area. This is a perfect example of the value of post-mortem examinations; it can give you an answer as to what happened to the animal, why it died, and can help find solutions to potential diseases and other problems occurring in the herd.

It's a good idea to do post-mortem examinations when you see changes in production, such as increased mortality or morbidity, or decreased productivity. If you sell isoweans, feeders or replacement gilts, or run a boar stud, there can be a lot of downstream effects when health issues occur. It's a good idea to get a clear picture of what is happening in the herd, and post-mortems will certainly help with that. Post-mortems will also be useful when you change genetics or start up a new herd. Post-mortems are especially important for quarantine barns. You want to investigate if there is an infection going through the herd, in which case the pigs should not be introduced to the main herd, or if the death is a one-off that is of no concern.

Post-mortems help people learn. It can be used as a training tool for barn staff that are looking after and treating pigs. For example, when a pig has a joint that is very swollen and staff are treating it in hopes of making it better, it can help to euthanize that pig, open up the joint, see the puss coming out and notice that the joint under it is completely damaged. Seeing this will make people realize that they wouldn't have been able to save the pig, no matter how hard they try and how much they treat that pig. It also helps teach the value of doing effective treatments and starting treatments early. When people have a better understanding why they do certain treatments and why certain things may or may not work, they will stay more engaged and be more likely to do the right thing.

> "Postmortems are beneficial when you see changes in mortality, morbidity, or reduced productivity."

To get started with post-mortem examinations on-farm, the most important tool you will need is a sharp knife and a sharpener (but a scalpel blade could also work). You may also need a snare or a board and a captive bolt gun to euthanize the animal. Make sure to wear some PPE, such as gloves and safety glasses. Having a camera on hand can be useful to take pictures or videos that you can send to your vet, or to share with barn staff. To get the most out of a post-mortem, you may want to take samples and take them to a lab for analysis. In this case, you may need any of the following: blood tubes, vacutainer needles, a clipboard and paper, pen or marker, bags, a watertight container, and swabs. Ideally all these things are kept together in a kit for easy retrieval. You may also need ice depending on transport, or formaldehyde to store samples in. Collecting blood or other samples before euthanasia, also called antemortem samples, can be helpful. Just remember that you only get one chance to take these samples.

Post-mortem examinations can be done by producers themselves, or by a veterinarian. If the vet is coming out, make sure everyone in the barn is aware that certain carcasses need

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livestock industry on the island. Jen originally started her career in the social sciences. She then started working for a NGO that was the first one to address the importance of farm animal welfare in Taiwan, where she translated European research on sow stalls. She enjoyed the field of pig welfare so much that she moved to Edinburgh for a MSc on sow enrichment. She continued her education with a PhD at the University of Edinburgh and Teagasc in Ireland, where she looked at tail biting. She followed that up with a post-doctoral fellowship at the University of Pennsylvania, where she researched sow housing, and then did another post-doc back in Ireland, Austria and France looking at pigs' social environment. After all that, she landed the position of research scientist in ethology and welfare at the Prairie Swine Centre where she will continue the great work done by Jennifer Brown and Harold Gonyou before her and start new projects.

As European producers are no longer allowed to dock tails, they are trying to find ways to manage tail biting in grow-finish pigs in fully slatted systems. Jen investigated wood as the primary enrichment and discovered that wood is generally safe for pigs, but the level of interaction with the wood depends on the type of wood. In a trial looking at a single enrichment in combination with a high fibre diet, a high level of tail biting occurred, which made her look at other types of meaningful enrichment that are slat compatible. She provided multiple enrichments at the same time, including grass in a rack, wood on the wall, and several hanging and loose items on the floor, and tail biting was much reduced in these pigs. A summary of this research will be included in the 2024 PSC Annual Research Report for anyone interested in more details.

Many producers in the USA and Canada are already using group housing for gestating sows, but most farms still use sow stalls for a period after weaning to facilitate breeding and pregnancy checking. As Proposition 12 in California does not allow sows to be housed in stalls after weaning, farms will need to change their systems to become prop-12 compliant. At the University of Pennsylvania, Jen was involved in a research trial with sows in individual stalls, individual pens or group pens for 8 days post-weaning and looking at a range of welfare measures, such as lesions, postures and different behaviour assessments. Their results showed that group housing is not just about the space but also about providing the opportunity to have proper social interactions. A summary of this study will also be included in the 2024 PSC Annual Research Report.

Future projects will focus on the development of replacement gilts and their impact on sow mortality.

> "Providing multiple forms of enrichment resulted in a reduced level of tail-biting."

Switching gears to sow housing in Canada, Jen provided an overview of the Code of Practice for the Care and Handling of Pigs review that was done in 2019-2021, which recommended that all sows should be housed in groups by July 2029. Because we see higher sow mortality during the transition, one of Jen Brown's recommendations last year was to focus on the development of replacement gilts. This will be looked at further in an upcoming research project.

Another project at PSC that recently finished looked at environmental enrichment to pigs either in early life (2-9 weeks of age), late life (9 weeks to slaughter), or both. Pigs receiving enrichment in late life or in both periods had higher weight gain at 18-21 weeks of age than pigs not receiving enrichment. Damaging behaviours such as pen mate manipulations were reduced when pigs received enrichment, showing that enrichment is indeed effective.

Looking forward to the coming year, a new project starting soon will look at thermal profiles of pigs and how that related to feed efficiency and stress response. Another project will analyze data from a commercial operation that has some barns with group-housed sows and others still in stalls to see the difference in sow performance under similar management. This data will also be used to study the feeding patterns and social behaviour with the ESF system and how that relates to sow productivity. Based on the results, a set of interventions will be designed and evaluated to improve gilt development in ESF systems on commercial farms. Another exciting new project will look at loose lactation systems compared to conventional farrowing crates. There are now loose lactation systems available on the market in Canada, so this is a good time to look at piglet performance and welfare in these systems and to gain feedback from staff working with these systems. Last but not least, an ongoing study on creep feed will look at different types of creep feed and effects on piglet growth and development.

Advancing swine welfare practices to empower your industry: What the Chair in Swine Welfare is doing for you

Martyna Lagoda
Post Doctoral Fellow
Western College of Veterinary Medicine, University of Saskatchewan

Martyna Lagoda, a post-doctoral fellow at the University of Saskatchewan working for the NSERC Industrial Research Chair in Swine Welfare under the supervision of Yolande Seddon, gave an update at the 2024 PSC Producer Meetings on the research results and tools developed by the Chair in Swine Welfare for the Canadian swine industry. Martyna started her presentation by explaining that the Chair program was put in place in 2018 as a strategic initiative to provide a proactive rather than reactive approach to swine welfare pressures, with total funds of $2 million provided by 14 industry partners, the Federal government, and the University of Saskatchewan. The Chair created a team of highly trained individuals with expertise in animal welfare and an understanding of the needs of the pork industry to develop practical solutions to welfare challenges. In addition to the Chair program, the team has tackled a breadth of research areas from sow management and grouping strategies, lifetime welfare of growing pigs, pain management, welfare assessment and biomarkers, environmental enrichment, to swine transport.

The Chair program was designed with two overarching objectives, which contained four major research goals:

1) Investigate beneficial pathways to support the pig in fully-slatted systems:

- Goal 1: understand how early-life management contributes to pig robustness, sociability, and welfare in the growing pig;
- Goal 2: identify if promotion of play behaviour can increase physiological and psychological robustness and confer benefits to resilience and productivity of pigs.

2) Develop tools to monitor and measure welfare:

- Goal 3: identify and validate biological markers for objective assessment of pig welfare;
- Goal 4: understand the value of carcass assessment to inform on animal welfare on-farm and during pre-slaughter handling.

Early-life development is critical to welfare and to how pigs cope with stress later in life. Goal 1 investigated optimization of welfare in fully-slatted systems by modifying early-life management in farrowing and nursery to support an improvement in lifelong welfare outcomes and productivity of pigs. Management modifications included provision of chewable materials to support chewing and rooting (natural behaviour expression and preparing for ingestion of feed), positive human contact to reduce fear, and extra space to develop social behaviours. Pigs receiving these modifications in both farrowing and nursery had improved average daily weight gain in the nursery and throughout life. They also had reduced skin lesions upon mixing suggesting improved social skills and improved handleability likely due to reduced fear of humans. There were fewer bitten tails in the nursery phase when pigs received early-life management modifications. Overall, results show improved welfare and suggest lower associated stress levels, resulting in improved weight gain and less damaging behaviour in pigs that received early-life management modifications.

Goal 2 is based on supporting positive welfare through the provision of play opportunities. Historically, producers were asked to reduce negative experiences in the pigs' lives such as castration and tail docking pain. Nowadays, it is increasingly recognised that caring for animals must also foster positive experiences: promoting positive human-animal relationships, supporting pigs to form social bonds, and providing play opportunities as a rewarding experience. To determine whether play can be supported in intensive production systems, and whether it confers benefits to resilience and productivity,

pigs were reared with daily play opportunities (enrichment and extra space) from birth, and every second day during a disease challenge (PRRSv infection) starting four weeks post-weaning. When mixed for transport and throughout the disease challenge, play pigs had reduced skin lesions suggesting reduced aggression. Play pigs were more active before and during the infection period demonstrating less sickness behaviour. Play pigs were less likely to experience respiratory distress (probability: 35% vs control pigs: 91%). Play pigs had higher daily weight gain in the second half of infection than control pigs (Figure 1). The results show that play behaviour can be promoted in intensive production systems and can offer a promising tool to support good welfare, resilience, productivity, and animal care practices that align with consumer values, supporting a positive image of pork production.

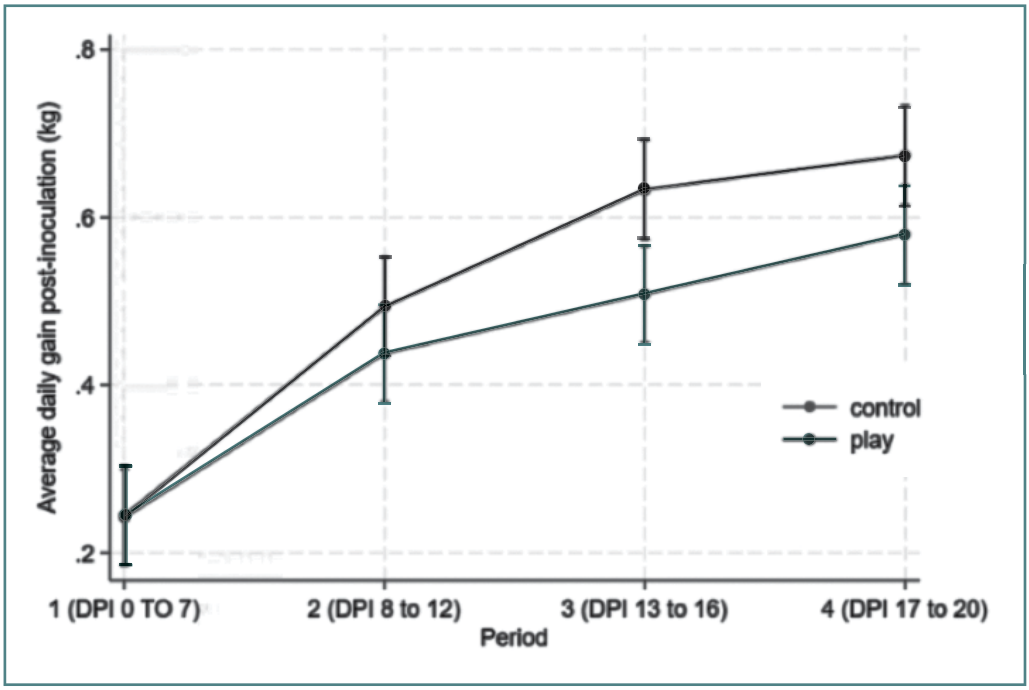

Figure 1 Comparison of average daily gain during the infection period (DPI: days post infection) in control and play pigs. Data are presented as predicted mean and 95% confidence intervals. Star indicates a significant difference between treatments.

Biomarkers of stress and welfare in pigs are currently lacking but are needed to support objective comparisons of welfare in different production systems and in individual animals. Cortisol and DHEA found in hair, as well as their ratio were validated as a measure of chronic stress from which to evaluate welfare in Goal 3. These hormones are deposited from the blood stream into the hair shaft as it grows, and their levels are analyzed in shaved hair to inform on stress levels experienced by an animal retrospectively, over the period of time represented in the hair growth. Results from a collaboration with Iowa State University show that cortisol and DHEA-S levels in hair are a heritable trait, and good potential biomarker candidates to select pigs that are better able to cope with stress. Using the ratio of cortisol to DHEA, the team identified lame piglets had a higher cortisol:DHEA ratio, indicating a major physiological stress and potentially a lower stress coping ability, and evidence that the ratio of cortisol to DHEA shows value as a tool for individual pig welfare assessment.

Goal 4 evaluated the value of carcass assessment to measure welfare on-farm and during pre-slaughter handling. This project was conducted in response to the industry's need to collect high-quality welfare data that is quantifiable and objective, in a practical way that can complement data from on-farm welfare assessments. Welfare data allows the industry to improve transparency in reporting and support public trust in the quality of Canadian pork. It also helps to benchmark on a national level and to track the success of on-farm management practices in supporting continuous improvement. The project investigated whether animal-based welfare indicators on carcasses are related to animal- and resource-based welfare measures on-farm and in pre-slaughter handling, to provide a herd diagnostic tool. The second objective was to automate the scoring of carcass lesions using computer vision (artificial intelligence). A camera was installed in an abattoir at a turn on the line, post scalding and dehairing, to permit viewing of lateral and dorsal sides of the carcass. Footage was analyzed by two observers and scored for skin lesions (fresh: measure of recent aggression, i.e.: during transport, and old: aggression on-farm), tail length (reflective of on-farm docking practices), tail and ear lesions, hernias, frostbite, human handling lesions, loin bruises and bursitis. Data showed that 64% of tails are docked very short, likely as a measure to curb tail biting. However, mild tail biting lesions were still recorded on ~40% of pigs, providing feedback on the effectiveness of current management practices to curb the risk of tail biting. Data also support the predictive value of carcass indicators as a herd diagnostic tool for welfare on-farm and during pre-slaughter handling. The automated scoring system can identify and track carcasses, extract lateral and dorsal sides, and carcass sections such as ears, tail, shoulder, mid-section, and rump with high accuracy. The system is currently being trained to identify and quantify lesions of importance to welfare. Overall, the automation process has been successful allowing for commercial level uptake.

In conclusion, the NSERC Chair in Swine Welfare provided information and tools that the industry can employ to promote Canada as a leader in pork production and quality, and to elevate Canada's options and conversations on animal care. The Chair is currently up for renewal and conversations are now taking place regarding future directions. Moving forward, the team is now looking to support industry implementation of goals 1, 2 and 4 in commercial production systems this summer. Starting this fall, the team will begin work on addressing sow mortality by identifying risk factors and providing advice on mitigation. Please get in touch with Martyna (martyna.lagoda@usask.ca) if you wish to participate in any of these commercial trials.

Advances in Nutrition for Improved Pig Health

Dan Columbus, Ph.D.
Research Scientist, Nutrition
Prairie Swine Centre

Antimicrobial stewardship has become an increasingly important topic and there has been an increasing pressure to reduce antibiotic use in livestock. This has raised the question how we can feed pigs to prevent disease and to reduce negative outcomes from illness. Dan Columbus, nutrition researcher at Prairie Swine Centre, presented his work regarding advances in nutrition for pig health at the 2024 PSC Producer Meetings.

As producers know, sick pigs grow more slowly and cost more money. Even sub-clinical disease reduces lean gain by 20-35% and feed efficiency by 10-20% and results in a financial loss of ~$8-30 USD per market pig. This is excluding costs for increased antibiotic use, diagnostic fees, etc. Because sick pigs are less efficient, they produce ~6% higher CO_2 emissions than healthy pigs, which is another reason why we should address this topic. A lot of research has been done in the past 10 years looking at alternatives to antibiotics. While there is no such thing as a true alternative to antibiotics (nothing works quite like antibiotics do), we can look at what we can include in the diet to support the animal's growth, immune function and gut health. Some things that seem to work, such as spray-dried plasma, zinc and copper, have their own health and regulatory issues. Instead, nutritionists are now looking more at the functional value of ingredients and including gut friendly nutrients like omega-3 fatty acids and different types of fibres.

In his research, Dan focused on the functional value of amino acids (AA) for disease. Amino acid requirements are currently based on growth performance and have been developed under high health conditions with fast growing animals with appropriate feed intake. It can be argued that these requirements are not appropriate for unhealthy pigs or pigs being disease challenged. In a study by Rodrigues et al. (2021), pigs challenged with different types of diseases, mycotoxins, or poor housing conditions all had reduced growth performance, but only part of that reduction was due to a change in feed intake while the rest was due to a change in maintenance requirements. In addition, young animals have a more drastic initial response to a disease challenge but recover faster than older pigs.

> "Nutrient requirements for development and immune response will be different than for growth performance."

In a healthy pig, a small amount of the dietary AA gets used for maintenance and the majority is used for growth. When an animal gets sick, this shifts so that the majority of AA gets used for the immune response and less gets used for growth. Because feed intake is reduced in sick animals and the nutrient profile is based on healthy animals, sick animals start to catabolize protein from their muscle stores to get the AA they need for the immune response, which makes the problem worse. Several research trials have shown that some specific AA have benefits beyond growth to support the health of the animal. These include the sulfur AA – methionine and cysteine – as well as threonine and tryptophan. For some of these AA, the research has shown that the requirements are increased during a disease challenge, which is not the case for all AA. This shows that the AA profile needs to be different for sick pigs vs. healthy pigs.

Dan looked at the effect of dietary fibre and immune stimulation on threonine requirements in growing pigs. He fed either a low or high fibre diet to either healthy or disease-challenged pigs. Results showed that the threonine requirements increased both when feeding a high fibre diet vs. a low fibre diet and when

feeding a sick pig vs. a healthy pig. However, when feeding a high fibre diet to a sick pig, the threonine requirements did not increase further. The dietary fibre increased the barrier function in the gut. Gut leakiness increased in pigs on the low fibre diet that were disease challenged but feeding high dietary fibre prevented the gut from becoming leaky.

A set of research trials looked at the effect of a blend of functional AA, consisting of 120% of the NRC (2012) requirements for threonine, methionine and tryptophan, in nursery pigs challenged with Salmonella. The first trial looked at the effect in low or high protein diets and showed that for the 7 days before the disease challenge, the functional AA blend did not affect growth rates. However, after the Salmonella challenge, growth was reduced much more in pigs not fed the functional AA blend, regardless of the protein content in the diet. The functional AA prevented some of the growth reduction after the Salmonella challenge in both the low and high protein diets. This shows that the functional AA don't have an effect in healthy pigs but become important once pigs go through a disease challenge. Indeed, pigs fed the functional AA had reduced Salmonella shedding and improved fecal score. Feeding the functional AA blend for two weeks before a disease challenge resulted in better growth than when fed one week before the challenge or at the start of the challenge, but growth was still improved to some extent when starting the functional AA blend at the start of the disease challenge.

The second trial looked at functional AA in plant vs. animal protein-based nursery diets. This trial was set up in a different way, such that the plant and animal protein diets and the functional AA were provided for 4 weeks after weaning, and then pigs were switched to a common grower diet a week before the disease challenge. So measurements to the response of the disease challenge happened at a time that the pigs were not receiving the functional AA supplementation anymore. Results showed that pigs on the plant protein-based diet did not do well after a disease challenge. The functional AA blend attenuated some of the negative effects in these animals. Pigs fed animal protein-based diet grew much better after a Salmonella challenge and the functional AA did not have much of an effect in these animals. This suggests that there are other active compounds in animal-based protein that are useful for pigs in a disease outbreak.

The last research trial looked at functional AA in low (average 1.1 kg) vs. normal (average 1.6 kg) birth weight pigs, again feeding the functional AA for 4 weeks in the nursery period, and then switching them to a common grower diet a week before the Salmonella challenge. Functional AA supplementation improved growth performance after the Salmonella challenge in normal birth weight pigs, but not in low birth weight pigs.

In summary, nutrient requirements for development and immune response will be different from those for growth performance. The response of pigs to challenges such as diseases or unclean environments is affected by age and sex of the pigs, and the type of challenge. Adjusting dietary amino acid content can improve growth performance, development and immune response in a disease challenge, but the positive effects will depend on the time supplementation is given, the protein source, and the birth weight of the pigs.

(Seek and you shall find... cont'd from page 2)

to be kept aside for the vet, so nobody cleans them up before the vet arrives. Also make sure to provide farm information such as location, genetics and feed provider, as well as vaccine and treatment history. Other important information to provide is the health status of the herd, stage of production and area of the barn where the death(s) occurred, the animal ID, time of death, whether the animal was euthanized or found dead, and if the carcass was frozen before necropsy.

Use a systematic approach for the post-mortem examinations. Doing it the same way consistently minimizes missing an important piece of the puzzle. Start by looking at the outside of the pig; look at the skin and the joints, is there any swelling or discoloration, are the eyes bloodshot, what do the ear tips look like and what is the body condition of the animal? To open the carcass there are two approaches. The ventral approach, which is best for smaller animals, entails laying the animal on its back, flaying both front legs and splaying the animal out so that the legs lay on their own without being held. Then cut through the costochondral junction on both sides and remove the resulting triangular piece. For the lateral approach, which works better for larger animals, lay the animal on its side, and start with the front leg by lifting and cutting the space that is created by this. There is no joint connecting the front leg to the chest. Then cut along the rib joints and splice the ribs to get them out of the way. Both approaches give you access to the thorax, which contains the heart, lungs, thymus (younger pigs only) and lymph nodes, as well as the abdomen, where you'll find the liver, digestive tract, kidneys, the bladder, and the omentum (fatty tissue layer). Another thing to look at when doing a necropsy is the joints, especially if the animal was lame. Next on the list to check is the head, which includes the tonsils, tongue, nasal turbinates and brain. For example, the tonsils are used to check for African Swine Fever.

Further analyses can be done on collected samples like swabs, samples fixed in formalin, or fresh samples. These analyses can include histology, cultures, or molecular diagnostics, and they can help get some answers as to what was wrong with the animal. For example, PCV2 and PCV3 showed up through molecular diagnostics in a pig's heart that looked completely normal with the naked eye.

In summary, it's not complicated to open up a pig and have a look. It's a good idea to do post-mortem examinations to learn and get answers. And remember that your herd veterinarian is a valuable member of your team and can help with necropsies.

P1 development strategies for peak performance

Kendall Weger,
Technical Services
Specialist
PIC

Gilt development is among the most important areas of reproduction management, and it is a very exciting topic thanks to the impact it can have on whole herd performance and achieving genetic potential. Kendall Weger, Technical Services Specialist at PIC, presented a lot of great data and tips around P1 development in her presentation at the PSC Producer Meetings. The industry is currently challenged by large sow losses of 15-19% between the first and second parity (P1-P2). The main reasons for sow removals are reproduction-based including failure to conceive (~21%) and failure to get back in heat (~18%). Another 10% is lost due to lameness. These factors can partially be prevented with good gilt development.

A sustainable P1 development program should consist of three important areas, including selection intensity, gilt eligibility at first mating and parity 1 preparation. The first step in a P1 development program is selection intensity, which is all about the gilt pool and making sure the right quantity and quality of gilts are available for selection decisions to start off with the best females. There are two main components of selection intensity. The first one is making sure the gilts' vital needs are met, including feed, water, space, health, and environmental conditions. All these factors determine growth performance of the gilts. It is important not to limit growth because that can affect the reproductive outcome and the expression of estrus. The second component to selection intensity is puberty management. This includes starting puberty stimulation at the right time to ensure that gilts are bred at the right age and weight and on their second heat. This results in a bigger pool of gilts so we can have better selection intensity.

Gilt selection is a two-part process. The first part is removing gilts to be culled. Most farms do a good job removing gilts that are growing slowly, have belly ruptures and other obvious defects. Oftentimes, the selection process stops here; if a gilt has the right plumbing and she can walk, she gets bred. However, farms should be doing a second step to select gilts to be 'prime' because that's how we can optimize sow lifetime performance. This step includes evaluating the vulva, teats, legs, hooves, and locomotion.

> "A solid gilt program is an essential part of the foundation for improved retention."

In order to maximize the quantity and quality of gilts available for the selection process, make sure to troubleshoot fall outs prior to selection. If you have a high mortality rate before the selection process starts, you get too few animals to choose from and you have to breed sub-par animals to maintain the herd flow. Also review the placement plan for the gilt development unit (GDU), including limitations and bottlenecks. These often include a limitation of space and the age at which gilts are received, which is sometimes older than ideal to start puberty stimulation. Also think about managing the sow inventory and the GDU flow to avoid disruptions. Ask yourself what you're doing with the non-select gilts. The culls and pigs in hospital pens often get the most space. However, the space should really be optimized to be used for prime gilts.

After gilt selection, the next step in a sustainable P1 development program is gilt eligibility at first mating. There are four elements that are important in this aspect: age at puberty, age at breeding, body weight at breeding, and number of estruses. When all four aspects are combined, there

is a synergistic effect on lifetime performance and retention. Unfortunately, it is a common scenario that farms struggle to achieve all four. For PIC gilts, the ideal situation (ideal fertility quadrant) is to hit puberty at an age younger than 195 days, age at breeding between 200 and 225 days, body weight at breeding between 135 and 160 kg, and have one heat-no-service (HNS) before breeding (so breed on the second estrus, or the third estrus if the gilt is too light). Breeding within the ideal fertility quadrant improves farrowing rates, lowers sow removal rates, improves gilt utilization and results in more pigs weaned. In a field example, gilts that hit the ideal fertility quadrant had 17% lower removals due to reproductive reasons, 27% lower removals due to locomotion reasons, 7 points higher retention up to P2 and 2 more pigs weaned up to P2 compared to gilts that didn't hit the ideal fertility quadrant.

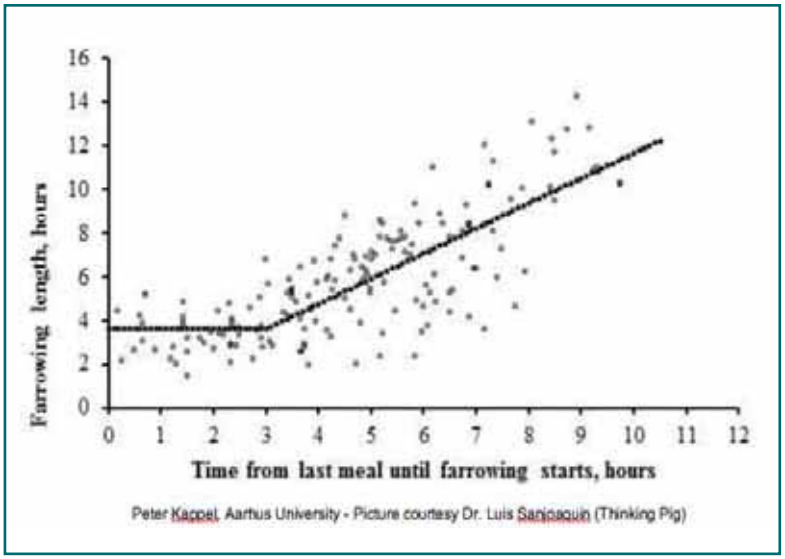

Figure 1. Connection between time from last meal until start of farrowing and the length of farrowing.

Getting a first estrus by the age of 195days is a critical step in hitting the other three targets. This is done by starting boar exposure no later than 24 weeks of age to stimulate puberty. Direct boar contact is best to induce puberty. An early response to effective boar stimuli is a critical selection tool. This allows the 'select' gilts to be bred at second estrus and at an acceptable target weight. Make sure to allocate enough labor and high-quality boars to the puberty stimulation program. While most farms will measure things like farrowing rate, pre-wean mortality, sow death loss etc., many farms won't measure key performance indicators (KPIs) in the GDU. Consider measuring things like gilt utilization rate, age and weight at first heat, % of gilts bred over 160 kg, and % of gilts bred over 225 days of age to get an idea of where you're at and where you could improve.

Trouble shooting fallouts prior too selection will help to maximize the quality and quantity of gilts available.

The last area of the P1 development program, which is often overlooked, is preparation of gilts for their first farrowing and lactation. This starts with feeding management in gestation. Don't underfeed gilts in gestation as they are still growing. Consult with your nutritionist for appropriate feeding levels. Body weight at first mating and body condition at farrowing entry are the most relevant time points for P1s. Measure the weight with a weight tape rather than a caliper because calipers don't provide an accurate measurement of gilt body condition. Pre-farrowing management is important to reduce the farrowing duration and post-partum recovery. Water intake and feed management pre-farrow are key basic sow care practices. Figure 1 shows that farrowing length is increased when there's more time between the sow's last meal and the start of farrowing. As increased farrowing length results in a higher risk of stillborns, it is recommended to feed several small meals per day, rather than one large meal per day. It is recommended to not feed females full feed pre-farrow.

It is also important to make sure that the gilts know how to drink and are drinking well at least 24 hours before farrowing, which is when they are the most active and drink the most. In the hours and days after farrowing, activity level and water intake go down. Getting P1s to eat well soon after farrowing is finished is important because sows that start with a low feed intake after farrowing never catch up to sows that eat well right away. Low feed intake during lactation will result in more body weight loss and a higher chance of sow removal by P2. Higher and consistent feed intake in lactation is associated with better reproductive performance and lower body weight loss in lactation. To stimulate voluntary water and feed intake, get sows up twice a day. Also check for fever and other problems at this time. Take steps early on to reduce the need for preventable interventions.

Some KPIs that are good to track P1 success are pigs weaned per farrow and the percent of P1s weaning 0 pigs. Some gilts will get sick, dry up, are not eating or drinking, or are otherwise unable to take care of their litter, so getting data on how many P1s weaned 0 pigs is a good indicator for how successful our P1 development program is.

In summary, a solid gilt program needs to be considered a foundation for improving retention, lower sow death rate and maximum weaning performance. Tracking is the first step to achieving results because you can't improve what you don't measure. And remember that a solid HNS program drives the decision making at breeding.

Insights into mycotoxins in swine diets

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Nutrition
Prairie Swine Centre

Mycotoxins are regularly found in ingredients used in swine diets and the issue seems to be getting worse. That's why Dan Columbus, nutrition researcher at Prairie Swine Centre, presented some insights into mycotoxins in swine diets at the 2024 PSC Producer Meetings.

Mycotoxins are secondary metabolites produces by moulds and fungi. While there are over 400 mycotoxins identified, only a few are of concern in livestock, including aflatoxins, zearalenone, fumonisins, ochratoxin, ergot and deoxynivalenol (DON, also called vomitoxin). In North America, DON is the most prevalent mycotoxin (showing up in 94% of tested finisher swine diet samples), followed by zearalenone and fumonisin. Co-contamination with several different mycotoxins is common, with about a quarter of samples testing positive for over 60 mycotoxin metabolites. The incidence of mycotoxins in grains increased in 2023 vs. 2022 and there is some thought that the prevalence will continue to increase due to climate change. The FAO has estimated that the cost of mycotoxins in Canada and the USA is $5 billion each year due to crop losses, reduced animal performance, costs associated with mycotoxin analysis, and use of feed additives.

Grains contaminated with mycotoxins are often downgraded to be used in animal feed as they will not be used for human consumption, which is why we often see mycotoxin issues in swine diets. Mycotoxins exert toxic effects and have adverse physiological effects when ingested by animals, resulting in reduced feed intake in most cases. At high inclusion levels, we'll see vomiting and reduced growth, and in some cases skin lesions, gut health problems, kidney and liver issues, and reproductive problems.

Pigs are more susceptible to mycotoxin intake compared to chickens and cattle, likely because pigs don't have a large microbial population that can detoxify the mycotoxins before digestion happens, as is the case for cattle (rumen) and to some extent chickens. The general thought is that older animals are better capable of handling mycotoxins than young animals, but Dan's research suggests this might not be entirely the case.

> "Research indicates that older animals are more susceptible to DON."

The CFIA and other regulatory bodies internationally have developed regulations and guidelines regarding the acceptable level of mycotoxins in complete feed and ingredients. The new CFIA regulations for mycotoxin levels are shown in Table 1. The CFIA does not allow blending of contaminated grain with non-contaminated grain. They do allow the inclusion of mitigants, and products are now able to be registered as mitigants in Canada, but they can only be used in diets with mycotoxin levels below the regulated levels.

Getting a good feed sample to test for mycotoxins is not easy, as mycotoxins are concentrated in pockets in the feed and, depending on where you take your sample, you may get very

Table 1. CFIA regulations regarding acceptable mycotoxin levels in complete feed and feedstuffs.

Mycotoxin	New Action Level	
	Complete Feed	Feedstuff
Aflatoxins	20 ppb	20 ppb
Deoxynivalenol	1 ppm	5 ppm
Fumonisins	10 ppm	20 ppm
Ergot – weaned piglets	1 ppm	3 ppm
Ergot – GF pigs	2 ppm	6 ppm

different results. Different labs will also provide different results. It is recommended to take multiple samples from different locations of the feed, mix those together to get a composite sample and to get a final sample from three to five different composite samples. An alternative to sampling the diet is to sample blood or urine from pigs several hours after a meal, as Dan's research showed a strong correlation between the level of mycotoxin (DON) in the diet and that in the blood and urine of pigs fed those diets.

With the high prevalence of mycotoxins in swine diets, the question begs what we can do about it? The best strategy is to avoid feeding mycotoxins or reduce the level of mycotoxins consumed. Definitely keep mycotoxins out of your breeding herd and nursery pigs. Other options include physical separation or the use of feed additives such as mycotoxin binders, yeast products, preservative blends or spray dried porcine plasma. Adsorbents and binders are non-nutritive feed additives such as bentonite/silicate clays and activated charcoal meant to deactivate or reduce absorption of mycotoxins. They are generally only effective against aflatoxins and may absorb useful nutrients as well. They do not adsorb DON at all. Another option is detoxification of mycotoxins by converting them into non-toxic metabolites. This can be done using certain enzymes, a probiotic or microbial blend, or antimicrobial agent such as sodium metabisulfite. More research is starting to come out with this class of mitigants. Physical removal of mycotoxins from the grain and grain sorting are possible but may not be economically viable. Research with porcine spray-dried plasma showed improved feed intake and growth performance in DON-contaminated nursery diets, but bovine spray-dried plasma did not have the same effect. Yeast products and blend products that contain one or more components such as antioxidants, amino acids, yeast products, plant extracts, etc. are the most promising products thanks to their multi-pronged approach to mycotoxin mitigation, including deactivation, biotransformation, protection of the animal and physiological support.

Previous research showed that while feed intake was initially reduced when grow-finish pigs were fed DON-contaminated diets (3 ppm) for 7 days, feed intake recovered near the end of the 7-day period. In a more recent study, Dan investigated whether 1 ppm is an appropriate maximum inclusion for DON. He set up two trials, one in finisher pigs (75 kg) for 6 weeks and one in grower-finisher pigs (35 kg) for 11 weeks feeding 0, 1, 3 or 5 ppm DON. Both trials showed no effect on general health indicators in blood samples, and no effect on nutrient utilization. In the finisher study, pigs fed DON had reduced feed intake and growth performance, but they recovered after 4 weeks. Body weight was not affected in pigs fed 1 ppm DON but was lower from day 7 onwards for pigs fed 3 and 5 ppm DON. In the grower-finisher trial, there was again no effect of 1 ppm DON, but the negative effects on performance of pigs fed 3 or 5 ppm DON was much more variable than in the finisher trial. In the grower period, the effects of 3 and 5 ppm DON on body weight were not clear cut. The effects did not become consistent until the finisher period. Average daily weight gain was reduced in the grower phase but not the finisher phase whereas feed intake was reduced in the finisher phase but not the grower phase when feeding 3 or 5 ppm DON. Overall, these results suggest that if you must use diets with mycotoxins (DON), it is best to feed them to grower pigs rather than finisher pigs. These trials also show that 1 ppm DON is a good cutoff level.

Dan Columbus presenting at the Manitoba producer meeting in Niverville, Manitoba.

In summary, mycotoxins will continue to be an issue for the livestock industry. Mitigation strategies are available, but efficacy depends on the mycotoxin present. The research trials suggest that older animals are more susceptible to DON and that there is some evidence of adaptation. Lastly, effects of DON are mostly due to feed intake rather than an animal health or nutrient utilization issue.

Personal Profile

Melvin Hagonob, BSc. Engineering MSc Student

Melvin is a professional Agricultural and Biosystems Engineer in the Philippines. He obtained his undergraduate degree at Visayas State University (Main Campus) in 2015. He worked under the Regional Agricultural Engineering Division at the Department of Agriculture from 2016 to 2023. He was also affiliated as a part-time instructor at the Central Philippine University, Philippines teaching agricultural and biosystem-related courses. Currently, he is pursuing his MSc degree program in Biological Engineering at the Department of Chemical and Biological Engineering, University of Saskatchewan. His research focuses on advanced artificial intelligence (AI) technology with machine vision and deep learning techniques for precise detection of real-time health and welfare conditions of pigs in different production stages and onset of farrowing.

Coming Events

Red Deer Swine Technology Workshop
October 9, 2024
Red Deer, Alberta

Saskatchewan Pork Industry Symposium
November 5-6, 2024
Saskatoon, Saskatchewan

Prairie Livestock Expo
December 11, 2024
Winnipeg, Manitoba

The NSERC Industrial Research Chair in Swine Welfare website is here!

PRAIRIE SWINE CENTRE

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