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PRAIRIE SWINE CENTRE

Fall 2020 Volume 27, Number 2

Weaner transport: Journey duration influences piglet physiology

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The transport of pigs is an integral part of pork production however it can be a stressful event for pigs with consequences on meat quality and animal welfare. Research has identified that many factors affect market pigs during transport, including temperature fluctuations, stocking density, vibrations, noise, the total time off food and water. We also expect these same factors will influence the health and welfare of weaned piglets during transport. However, relatively little is known on how transport influences weaned piglets, and if effects are additive close to weaning. Under the new Health of Animals regulation (Part XII: Transportation of animals, Section 19.0) released in February 2019, you can transport pigs of any age up to 28 hours without feed, water and rest. There is minimal information on how the length of commercial transport may affect piglet health and welfare in the short and long term. Research is currently in progress looking at how piglets respond to transport under commercial conditions.

What we did

This pilot study assessed weaner pigs traveling short (n=3, 200 piglets/load) and long journeys (n=3, average 2183 piglets/

load) from two different farms during summer months (Figure 1). Each load consisted of sixty piglets selected as focal pigs for close monitoring, being evenly distributed across specific trailer compartments. Data loggers positioned in focal pig compartments, recorded temperature and humidity continuously throughout the journey. Approximately, two days before transport focal piglets were weighed, scored for lameness, skin,

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Program funding provided by

Sask Pork, Manitoba Pork, Alberta Pork, Ontario Pork, Saskatchewan Ministry of Agriculture

Publication # 40010021

On-Farm Demonstrations Quench Thirst for Water Knowledge

Swine Innovation Porc

Geoff Geddes,
for Swine Innovation Porc

Water is something that's easy to take for granted…unless you're the one footing the bill. As pork producers grapple with razor-thin margins, cutting costs is critical.

"Reducing Water Consumption in Nursery Barns"
With a name like that, the objective of the first on-farm demonstration is pretty clear. Based on research results, the project team went on farm to determine if replacing conventional nipple drinkers with water bowls could reduce water disappearance.

Focusing on eight batches of nursery pigs, they equipped eight pens with bowls and eight with nipple drinkers. Using a water meter, the project team tracked the animals over nine months and found that water bowls reduced water disappearance by 33% compared to conventional nipple drinkers. Perhaps most importantly, the move to water bowls had no negative effects on pig growth performance.

Reduced water wastage from the bowls led to a substantial reduction in manure production. Such changes must be well managed, of course, to avoid the production of more solid manure and complications in manure removal that could result. Still, the results are significant, and the use of an on-farm assessment to gather data makes the findings instantly relevant in the real world. For the producer involved in the testing, the outcome prompted the farm to continue using the water bowls after the project.

This demonstration and its implications are timely to say the least. From a cost standpoint, less water wasted means lower manure application costs at a time when every dollar saved is critical for producers.

Beyond cost savings, however, there is the big picture to consider. Agriculture today faces tremendous pressure to lessen its environmental footprint, and for good reason. By reducing water wastage, pork producers can also shrink the area needed to spread manure, thereby demonstrating the industry's commitment to sustainability.

The potential of these results is intriguing, and it all begins in the barn. Additional on-farm assessments are needed to test bowl performance over a longer period and during different seasons, and to allow for documentation of the results.

"Effective Water Conservation"
Just as there is more than one way to skin a cat (but we won't go there), there are other options worth exploring to reduce water wastage on farm. This on-farm demonstration looked specifically at finishing barns to see if a trough with side panels and an integrated nipple drinker would prove effective.
In a research setting, the trough option reduced wastage and offered impressive water savings of 60% over conventional nipple drinkers. Like the first demonstration, there was no adverse effect on pig performance. Given recent findings at 24 Canadian hog farms, it was found that two-thirds of nipple drinkers measured (in finishing barns) provided higher than recommended flow rates. The project team then put the trough set-up to the test on a commercial farm.

After 24 weeks, the trough with side panels and integrated nipple drinker had reduced water disappearance by 20%. Though the results are interesting from a scientific standpoint, the priorities for producers are grounded firmly in reality: What will it cost to install? How much money will it save? How long until I get my investment back?

With material and labour, the trough configuration can be up and running for approximately $167 per pen. An average farm can expect to save $28.05 in water use per pen and $57 per pen in manure disposal costs. Though each farm is unique, the site involved in the on-farm demonstration is looking at 2 - 3.5 years to recoup their investment.

As for drawbacks, the trough must be washed regularly and there is greater potential for water contamination.
In weighing the pros and cons, the producer in this study was attracted to the substantial water savings and drop in manure volume offered by the trough with side panel setup. He may also have been motivated by the consequences of not making the change. Though critical for pig growth, water is frequently overlooked in pig production, resulting in an average wastage of 25% from nipple drinkers and up to 40 – 60% on commercial farms in Canada.

These two on-farm demonstrations present viable options for saving water, cutting costs and aiding the environment. In doing so, they both revealed the importance of on-farm demonstrations in regard to testing new technology and hastening its adoption by industry.

Oh, and if you still think water is an overrated issue, imagine your life without it.

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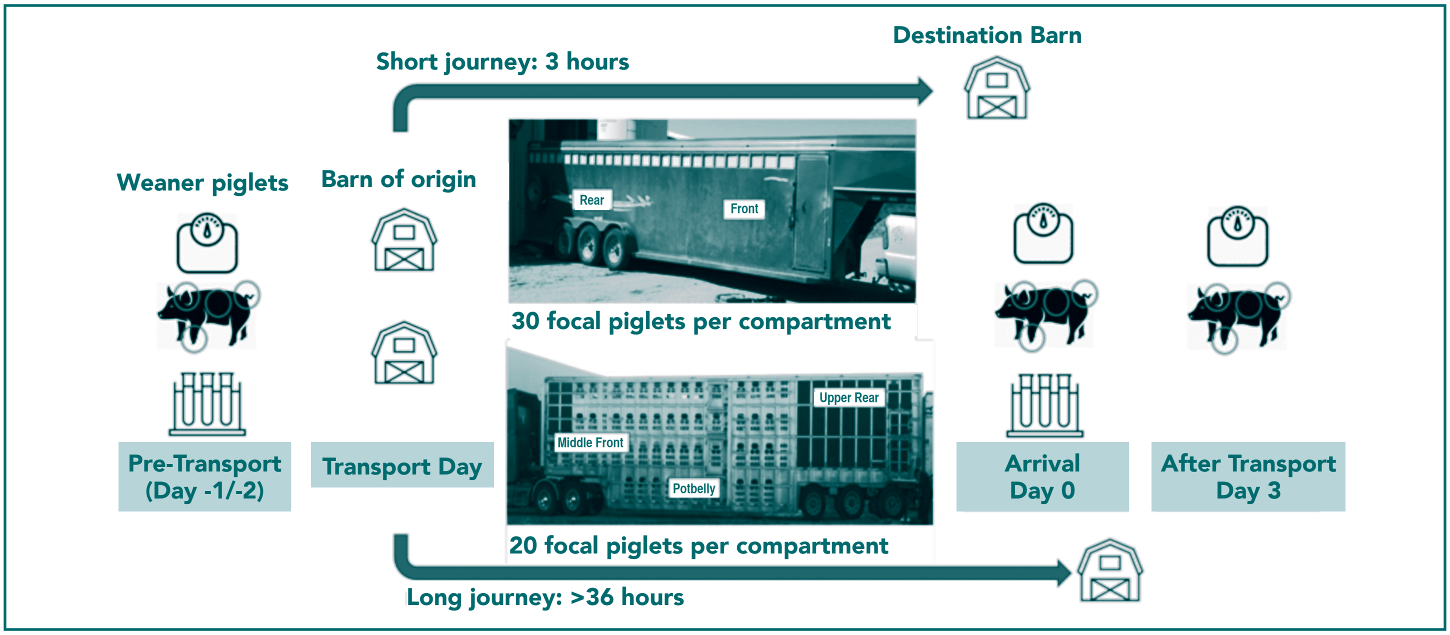

Figure 1. Diagram showing data collected (blood samples, weight, lameness, skin, ear and tail scores) timepoints pre, during and post transport, journey type and trailer type used for short and long haul journeys of weaner piglets.

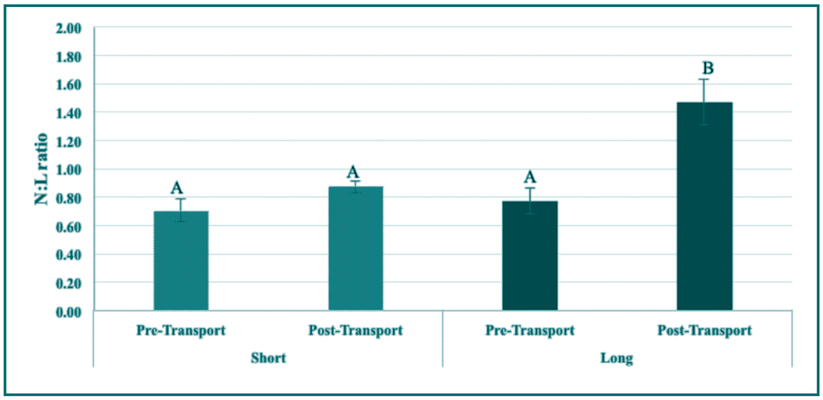

Figure 2. Mean N:L ratio in weaned piglets after short (3h, n = 60) and long (>36h n = 60) trips. Error bars indicate ± SEM. Different superscript letters within and between transport type indicates significant difference at the 5% level.

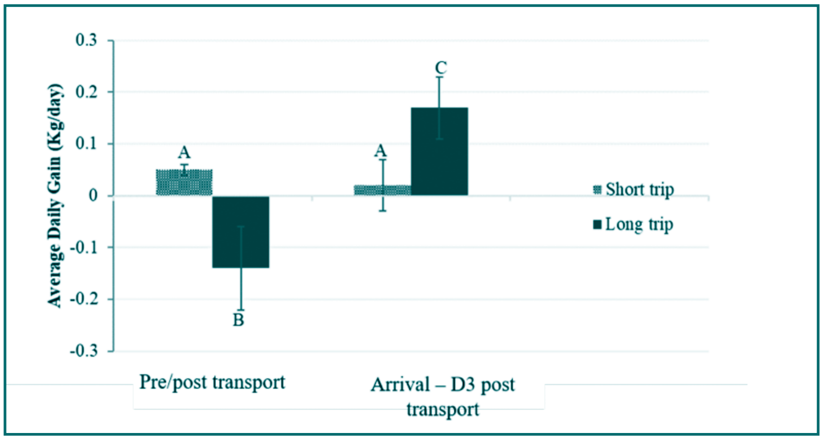

Figure 3. Mean average daily gain (kg) of weaned piglets (N=180/ trip type) over the course of short (3h) and long (>36h) transport. Error bars indicate ± SEM. Different superscript letters within and between time points indicate significant difference at the 5% level.

ear and tail lesions and 20 piglets/trip type/load were blood sampled. We repeated these measures upon arrival at the destination barn, along with recording the number of dead piglets (DOA). Piglet behaviour was recorded during (pig postures - standing, sitting, and lying) and for two days after transport. Piglet behaviour and weights were used to evaluate how piglets responded to, and their speed of recovery following transport. Morbidity and mortality to the end of the nursery period was also recorded. A range of tests were run on blood samples including a complete blood count including the neutrophil to lymphocyte ratio (N:L), serum cortisol, haematocrit, lactate and creatine kinase (CK); providing information on how the transport influences the piglets' physiological status.

What we found

Long haul journeys cause greater physiological stress

Piglets transported for long journeys had higher neutrophil to lymphocyte ratios (N:L) than those transported for short journeys (Fig 2). The post-transport N:L ratio of pigs from long journeys is outside of the typical ranges for piglets (0.6-0.8, Saugiharto et al. 2014) , which indicates that the long haul journeys caused physiological stress in the weaned piglets, and is capable of causing immune cell responses. Regardless of trip type, transport increased blood levels of creatine kinase, indicating some muscle degradation, potentially related to unloading activity.

Journey duration influences ADG

Long haul journeys resulted in weight loss during transport (calculated from the weight change from pre transport to arrival), (Fig 3). This weight loss likely results from the prolonged fasting period (>24hrs) arising from a long haul journey, with a continued

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Pig performance and the economics of long-term feeding of DON-contaminated diets

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What's the problem?

Mycotoxin contamination of feedstuffs used in swine diets continues to be a problem for producers. Research recently conducted at the Prairie Swine Centre has specifically focused on deoxynivalenol (DON), also known as vomitoxin, as it commonly contaminates corn, wheat, barley and other important feed ingredients. According to Biomin (2019), 85% of all grain samples and 90% of finished feed samples contained DON in North America. Data for wheat in Saskatchewan shows an increase in the incidence of fusarium, with 80-90% of wheat downgraded due to DON contamination. With advances in mycotoxin analysis it has become clear that the mycotoxin problem is much larger than thought and the costs associated with mycotoxin contamination will continue to increase.

Contaminated grains are commonly downgraded for use in livestock feed and, while the best strategy for livestock producers is to avoid feeding mycotoxin-contaminated grain altogether, with the increased incidence and level of contamination this is no longer a viable option. Therefore, many strategies have been proposed to eliminate or reduce the negative effect of mycotoxins in animal feeds. Most of these strategies are based on deactivation of the mycotoxin through binding of the mycotoxin using adsorbents, such as silicate clays and activated carbon, which can be included in feed as non-nutrient additives. In general, however, current feed additives are relatively ineffective in mitigating the negative effects of mycotoxins and may not be effective for all mycotoxins. For example, some adsorbent agents have proven effective at reducing the negative effects of some mycotoxins, such as aflatoxin, but have shown little or no impact in pigs fed DON contaminated diets. Recent studies have examined the use of additives consisting of different blends of yeast/yeast product, preservatives, antioxidants, amino acids, and probiotics which have shown potential for success in DON-contaminated diets in grower-finisher and weaning pigs. There are currently no additives available in Canada for use to mitigate the effects of DON.

As swine are one the most susceptible livestock species to the negative effects of DON, there has been an abundance of research on DON in pigs. In general, however, the majority of studies have been performed in young animals with the assumption that the negative effects of consuming mycotoxin contaminated feed is highest in the young animal. Moreover, previous studies have examined the impact of mycotoxins over a relatively short period of time. Therefore, we sought to answer the following questions:

> "Results indicate little to no change in returns when pigs are fed diets containing 1ppm of DON"

1. What is the long-term effect of feeding DON to grower-finisher pigs?
2. Is the effect of DON different in grower vs. finisher pigs?
3. What is the economic impact of feeding DON-contaminated diets to grower-finisher pigs?

What we did

Two growth performance studies were conducted to examine the impact of long-term feeding of graded levels of DON in finisher (75 – 120 kg) and grower-finisher (35 – 120 kg) pigs. In Study 1, 200 finishing pigs with an initial body weight of 76.6

Table 1. Growth performance of finisher pigs (75 – 120 kg) fed graded levels of deoxynivalenol

	CON	DON1	DON3	DON5	SEM	P-value
Body weight, kg						
Initial	76.9	77.0	76.3	76.0	1.18	NS
Day 7	85.4[a]	84.8[a]	83.0[b]	80.8[c]	0.34	<0.001
Day 14	95.3[a]	95.3[a]	92.4[b]	88.7[c]	0.42	<0.001
Day 21	103.4[a]	103.8[a]	99.8[b]	95.7[c]	0.50	<0.001
Day 28	112.1[a]	111.9[a]	107.8[b]	103.0[c]	0.53	<0.001
Day 35	119.7[a]	119.8[a]	114.9[b]	110.4[c]	0.63	<0.001
Day 42	126.7[a]	126.9[a]	123.6[b]	118.5[c]	0.80	<0.001
Average daily gain, kg/d						
Day 0-7	1.27[a]	1.18[a]	0.93[b]	0.60[c]	0.05	<0.001
Day 8-14	1.40[ab]	1.49[a]	1.33[b]	1.13[c]	0.04	<0.001
Day 15-21	1.17[ab]	1.21[a]	1.06[b]	1.01[c]	0.04	0.004
Day 22-28	1.24[a]	1.17[ab]	1.15[ab]	1.04[b]	0.04	0.033
Day 29-35	1.08	1.12	1.01	1.06	0.04	NS
Day 35-42	1.06	1.00	1.20	1.14	0.06	NS
Overall	1.19[a]	1.20[a]	1.12[b]	1.00[c]	0.02	<0.001
Average daily feed intake, kg/d						
Day 0-7	2.59[a]	2.59[a]	2.22[b]	1.70[c]	0.06	<0.001
Day 8-14	2.98[a]	3.07[a]	2.89[a]	2.55[b]	0.07	<0.001
Day 15-21	3.03[a]	3.03[a]	2.88[a]	2.56[b]	0.05	<0.001
Day 22-28	3.25[a]	3.19[a]	3.13[a]	2.85[b]	0.05	<0.001
Day 29-35	3.22	3.20	3.19	3.04	0.06	NS
Day 35-42	3.19	3.11	3.36	3.05	0.08	NS
Overall	2.99[a]	3.06[a]	2.94[a]	2.60[b]	0.05	<0.001

[a,b,c] Means within a row without a common superscript differ.

± 3.9 kg were group housed in pens with 5 pigs/pen. In Study 2, 240 grower pigs with an initial body weight of 35.9 ± 1.1 kg were group housed in pens with 6 pigs/pen. In both studies, pens were assigned to 1 of 4 dietary treatments (n=10 pens/treatment). Dietary treatments consisted of a control diet (CON) containing no DON or a diet containing 1, 3, or 5 ppm DON (DON1, DON3, or DON5). The basal diet was wheat-barley-soybean meal-based and formulated to meet or exceed nutrient requirements. The dietary DON levels were achieved by replacing DON-free wheat with DON-contaminated wheat and wheat screenings. Individual pig body weight and per pen feed intake were measured weekly for the duration of the studies (42 d for Study 1 and 77 d for Study 2) for determination of average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (gain:feed; GF).

In finisher pigs we found that there was a rapid negative response to > 1 ppm DON intake, resulting in a decrease in average daily gain and feed intake as well as reduced body weight within the first week (Table 1). The reduction in body weight was maintained throughout the study, however, after a period of approximately 4 weeks, the feed intake and average daily gain of all pigs had recovered. In grower-finisher pigs, the response to DON intake was less pronounced and not as rapid, resulting in variability in the response over time and across treatments (Table 2). Overall there was reduction in average daily gain, feed intake, and body weight in pigs fed > 1 ppm DON, however, this negative effect was less than observed in finisher pigs. There was no impact of dietary DON content on feed efficiency in either study. Overall, these studies provide further evidence for an upper limit of 1 ppm DON in finished feed to avoid reduced performance. While there was an initial reduction in performance, pigs seem to be able to adapt to DON intake of > 1 ppm and < 5 ppm.

What will this cost you?

The Prairie Swine Centre Enterprise Model was used to assess the economic impact of feeding DON-contaminated grain to pigs. It is important to note that the following assessment was based on the results of the current studies as well as a number of other assumptions (e.g., grid, market weight, current market prices). Therefore, these results are meant only as an indicator of the potential economic impact and the specific economics will be dependent on individual production parameters. Producers need to weigh several factors when considering

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(Pig performance... cont'd from page 5)

Table 2 Growth performance of grower-finisher pigs (35 – 120 kg) fed diets with graded levels of deoxynivalenol

	CON	DON1	DON3	DON5	SEM	P-value
Body weight, kg						
Day 0	36.0	35.6	35.7	36.4	0.34	NS
Day 7	42.5	41.6	40.7	41.7	0.44	NS
Day 14	50.1^{a}	49.8^{a}	47.8^{b}	49.2^{ab}	0.49	0.01
Day 21	58.0^{a}	57.7^{a}	55.7^{ab}	56.7^{b}	0.60	0.04
Day 28	68.1	67.6	65.4	65.7	0.84	NS
Day 35	75.9^{a}	74.5^{ab}	72.7^{b}	72.7^{b}	0.86	0.03
Day 42	85.2^{a}	83.7^{ab}	81.9^{b}	81.6^{b}	0.91	0.03
Day 49	94.7^{a}	93.1^{ab}	90.9^{bc}	89.8^{c}	0.96	0.005
Day 56	102.7^{a}	100.9^{ab}	98.3^{bc}	97.7^{c}	1.00	0.004
Day 63	110.6^{a}	108.6^{ab}	106.3^{bc}	105.0^{c}	0.91	<0.001
Day 70	118.4^{a}	116.2^{ab}	114.6^{bc}	112.9^{c}	0.91	0.001
Day 77	124.9^{a}	123.0^{ab}	121.0^{bc}	120.0^{c}	0.91	0.002
Average daily gain, kg/d						
Day 0-7	0.92^{a}	0.86^{a}	0.72^{b}	0.76^{b}	0.04	0.001
Day 7-14	1.09	1.17	1.02	1.08	0.04	NS
Day 14-21	1.14	1.13	1.12	1.06	0.03	NS
Day 21-28	1.44	1.42	1.38	1.30	0.06	NS
Day 28-35	1.15	1.12	1.14	1.11	0.04	NS
Day 35-42	1.32	1.32	1.32	1.27	0.04	NS
Day 42-49	1.37^{a}	1.34^{a}	1.28^{a}	1.17^{b}	0.04	<0.01
Day 49-56	1.13	1.11	1.05	1.13	0.06	NS
Day 56-63	1.13	1.11	1.15	1.04	0.05	NS
Day 63-70	1.13	1.08	1.18	1.13	0.04	NS
Day 70-77	0.93	1.03	0.91	1.00	0.06	NS
Day 0-42	1.17^{a}	1.15^{ab}	1.10^{bc}	1.08^{c}	0.02	<0.01
Day 42-77	1.14	1.13	1.11	1.10	0.01	NS
Overall	1.15^{a}	1.14^{a}	1.11^{b}	1.09^{b}	0.01	<0.001
Average daily feed intake, kg/d						
Day 0-7	1.59^{a}	1.55^{a}	1.40^{b}	1.42^{b}	0.04	0.002
Day 7-14	1.90	1.98	1.78	1.81	0.07	NS
Day 14-21	2.03	1.95	1.93	1.95	0.06	NS
Day 21-28	2.37^{b}	2.58^{a}	2.49^{a}	2.49^{a}	0.03	0.002
Day 28-35	2.79	2.77	2.67	2.60	0.05	NS
Day 35-42	3.17	3.07	3.09	2.95	0.08	NS
Day 42-49	3.17^{a}	2.95^{a}	2.96^{a}	2.71^{b}	0.08	0.004
Day 49-56	3.19^{a}	3.06^{ab}	2.99^{b}	2.94^{b}	0.06	0.01
Day 56-63	3.02	2.80	2.89	2.88	0.09	NS
Day 63-70	3.19	3.05	3.06	2.97	0.05	NS
Day 70-77	3.05	2.99	2.94	2.91	0.07	NS
Day 0-42	2.29	2.27	2.20	2.18	0.03	NS
Day 42-77	3.12^{a}	2.97^{b}	2.96^{b}	2.88^{b}	0.05	<0.001
Overall	2.62^{a}	2.55^{ab}	2.47^{b}	2.47^{b}	0.03	0.003

^{a,b,c} Means within a row without a common superscript differ.

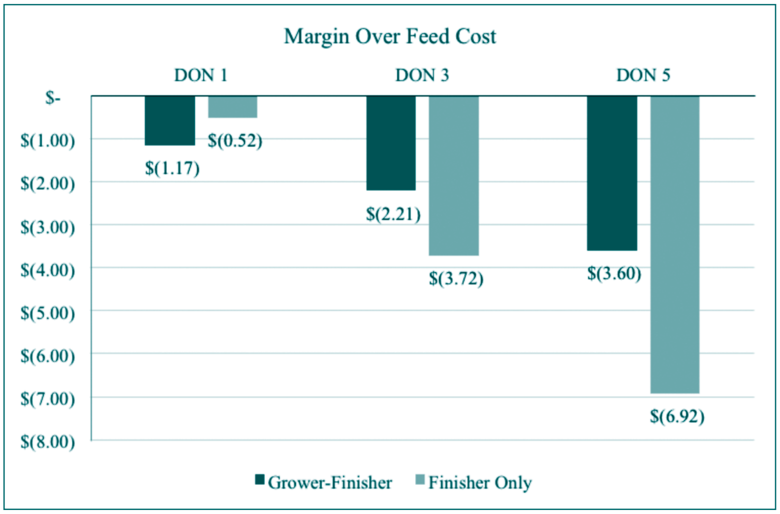

Figure 1 Margin over feed cost for diets containing various levels of DON

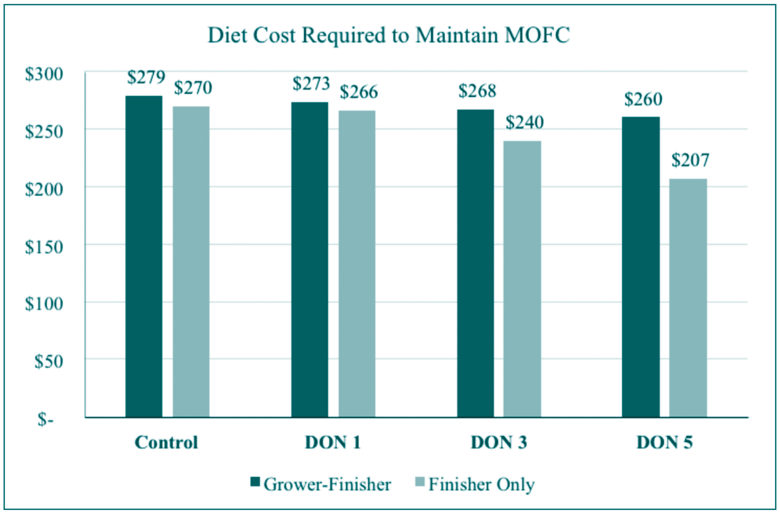

Figure 2 Diet cost required to maintain margin over feed cost to uncontaminated diets.

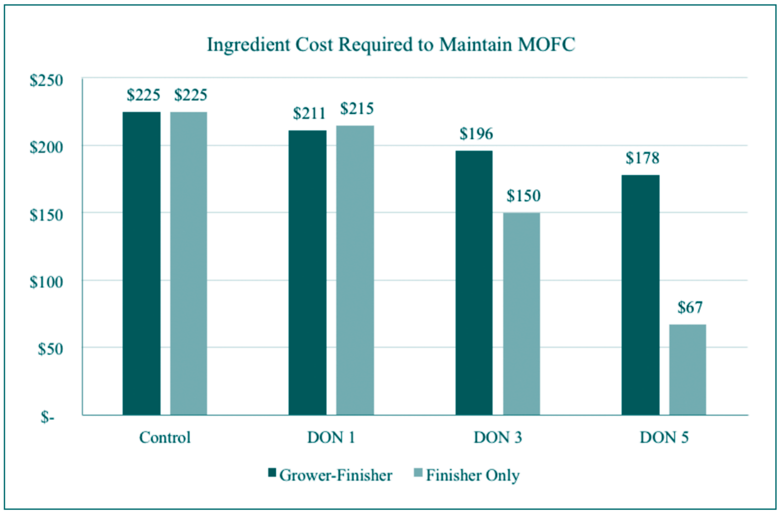

Figure 3 Ingredient price of contaminated grain, at 40% of the diet, required to maintain margin over feed cost at uncontaminated levels

feeding DON contaminated grains in their operations, the most important being - What are the costs associated with it? Results from this project have shown, that pigs consuming high levels of DON, in complete diets, will be 5-8 kg lighter by the time they reach market weight. However, these pigs also consumed less total feed. Does this drop in feed consumption, and total feed cost, outweigh the drop in market revenue from the sale of hogs at a lighter weight? The simple answer is no, however it depends when pigs are introduced to DON in their diets.

Figure 1 shows the margin over feed cost when pigs (at average market conditions) are fed varying levels of DON in complete diets and when DON is introduced at different stages in the production cycle. Results indicate little to no change in returns when pigs are fed diets containing 1 ppm of DON - regardless of when it was introduced. In both studies, no significance was found in final market weight between control and diets containing 1 ppm of DON. Results also indicate an inverse relationship between margin over feed cost and the level of DON in the diet for both studies, in other words increasing DON reduces producer returns. However, the negative impact on margin over feed cost is far greater when pigs are first introduced to DON in the finishing period. This indicates the negative impacts of DON are less when introduced earlier to pigs in the production cycle. Based on the results of this study we would estimate between a $2 -$7 per hog drop in revenue under average market conditions. Therefore, it would be in the producer's best interest to avoid contaminated grains when possible.

In order to balance the drop in returns (margin over feed cost), producers will need to buy DON contaminated grains at a discount, compared to clean grain, in order or make feeding DON contaminated grain a viable option. Figure 2 shows the estimated drop in finished feed cost (per mt) for various levels of DON contaminated diets required to have no impact to margin over feed cost (returns) to the producer. The finished diet will need to drop in price between $11 - $63 per tonne, depending on level of contamination and exposure to DON, in order to have no change in margin over feed cost.

Figure 3 displays the drop in (DON contaminated) ingredient price required when that ingredient would make up 40% of the total finished diet. If we assume clean grain can be purchased at $225/mt - producers will need to purchase the DON contaminated ingredient at a significant discount, up to $155 mt, in order to justify feeding 3 or 5 ppm of DON in a diet. It is important to remember an ingredient containing 2.5 ppm making up 40% of the diet translates to 1 ppm in the final diet, and it would take 12.5 ppm of DON in an ingredient to achieve 5 ppm in a diet.

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Infrared camera tech measured as tool for swine health

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Depending on the results of a nearly-completed research project, infrared cameras could soon become a key tool in the fight for swine herd health and the protection of Canada's swine export market.

The project -- a collaboration between the Prairie Swine Centre (PSC) in Saskatoon and the University of Saskatchewan's Department of Food and Bioproduct Sciences -- seeks answers to two questions. First, can infrared cameras be used to identify sick or stressed pigs before they're taken to the packing plant? Second, to what extent can they be used to predict a pig's tendency for poor meat quality?

"If producers can easily identify sick animals then they can determine whether it's better to treat or euthanize them on-farm rather than send them to a processor where they could pose a food safety risk," says Jennifer Brown, a researcher with the PSC and the project's primary investigator.

"Having a simple tool like this could improve the welfare of animals and reduce waste by not transporting animals that are not suitable for food, all while improving food safety," Brown says.

The potential for reducing disease in the supply chain cannot be underestimated, she says.

"Certainly the one disease we are very wary of in North America is African Swine Fever, which decimated pig herds in China last year. If it ever came to North America there would be a lot of concern that it would spread in our swine herds. It would be totally devastating for pig producers because our borders would be closed and we wouldn't be exporting any animals."

When combined with specialized software, infrared cameras can be used to identify high body temperature which -- just like with humans -- can be an indicator of sickness or stress.

"We are looking at pigs' body temperature in two regions," says Brown, an adjunct professor with the College of Agriculture and Bioresources who teaches half an undergraduate course in Animal and Poultry Science.

"We are looking at the back of the pigs, which is a large area we can get the average temperature from. We are also looking at the eye region because it has been shown to be one of the more sensitive areas in terms of responding to disease and changes in temperature."

Brown is collaborating with Phyllis Shand with the Department of Food and Bioproduct Sciences on the meat quality side of the project. This component looks at the potential of infrared tech in predicting a given pig's likelihood for winding up as substandard meat.

"It typically relates to a problem that is pretty common in pork meat which is known as pale, soft and exudative (PSE) pork," says Brown. "That's the main meat quality problem you might find in pork and it's usually related to transport and handling at high temperatures. PSE pork has a poor appearance and is not marketable as a fresh product,

"If we can identify pigs that are more prone to having that PSE trait they can be rested longer in pens. That's going to improve their meat quality."

Ultimately, infrared camera-based temperature detection will have to work at scale in order to be a true asset to the swine industry. Brown says the next step will be attempting to automate the image collection and analysis process (it's currently being done manually) so data can be gathered in real time.

"The hope is that we can automate procedures to collect infrared data so producers or packing plants would get a flag if an animal was to show a temperature over a certain threshold."

Although the project's goal isn't primarily related to animal welfare, there's no doubt that using infrared cameras to assess pig health is less invasive than alternative methods, she says.

"Infrared is a beautiful technology because you can assess an animal's temperature, whether it be the whole body or specific parts of the body, totally non-invasively. A lot of our stress assessments involve respiration rate, heart rate or blood pressure which all require some kind of contact or interference with the animals. With infrared the animals aren't aware of the process or subjected to any stress.."

A good piece of news -- especially for producers -- is that suitable infrared cameras have come down in price significantly in recent years. A sub-test of the project involved comparing the efficacy of a research-grade infrared camera (costing over $10,000) to a handheld counterpart that is available for around $1,000.

"We compared those two cameras to see if we were able to get data that was as reliable on the cheap camera as on the expensive one and it did very well in that comparison. That was not surprising since the technology is the same, with the main difference being the image resolution," she says.

This research is an example of USask's frequent collaborations with the PSC, an institution dedicated to swine research. Originally conceived as the university's swine research unit, since 1991 it has acted as an arm's length, non-profit agency associated with the university but operating as a distinct entity.

(Pig performance... cont'd from page 7)

There are additional considerations that producers must take in account when feeding DON-contaminated. In theory, if we could simply purchase DON contaminated grains cheaper we could maintain margin over feed cost, however, it is not that simple in practice and may not be possible. If these savings cannot be achieved, pigs fed DON-contaminated diets will need to be kept in the barn longer due to slower growth, increasing costs and reducing throughput. Adding 5 days to market adds approximately 4.5% to fixed costs, as fewer pigs can be marketed from the barn in a year. In farrow-to-finish operations, many facilities simply cannot afford to keep pigs 5 days longer. Logistics are another important consideration. If farms do not have the ability to separate the DON contaminated ingredients from clean grain, the entire herd would receive the DON ingredient – perhaps creating additional challenges in other parts of the production system. It is also important to note that this economic analysis examines the impact of feeding DON on based on one specific grading grid. As packers have different requirements, the change in margin over feed cost would be packer specific and shipping at lighter weights (associated with higher levels of DON) may be more detrimental in some cases. Finally, the use of DON-mitigating feed additives, while potentially effective, also result in increased feed costs, therefore, producers would need to weight the potential benefits against the costs of these products.

Take home message

1. In finisher pigs, feeding of diets with > 1 ppm DON results in an initial reduction in feed intake and average daily gain. This results in a reduction in body weight which is sustained over time. Growth performance recovers after a period of time, indicating that pigs may be able to adapt to DON intake. The response to DON appears to be reduced and more variable in grower pigs than in finisher pigs.
2. The negative effects of DON intake appear to be due largely to reduced feed intake. This is supported by lack of negative effects of DON intake on nutrient utilization, health status, and carcass quality.
3. Feeding diets containing > 1 ppm DON will result in reduced margin over feed cost. This reduction is greater when DON is first introduced in the finisher period compared to the grower period.
4. Producers may be able to feed DON-contaminated diets, up to 5 ppm, while making adjustments (e.g., reduced ingredient/feed cost, increased days to market, mycotoxin mitigating feed additives) for the negative impact of DON intake on growth performance.

Acknowledgements

These studies were supported by the Saskatchewan Ministry of Agriculture and the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, the Barley Development Commission of Saskatchewan, Biomin Holding GmbH, and Mitacs. General program funding for the Prairie Swine Centre is provided by the Government of Saskatchewan, Saskatchewan Pork Development Board, Alberta Pork, Manitoba Pork, and Ontario Pork.

(Weaner transport... cont'd from page 3)

expenditure of piglets body reserves. Piglets may compensate for this time off feed by increasing their feed intake upon arrival, as indicated by an increased ADG over the three days following arrival (Fig 3). This weight loss likely results from the prolonged fasting period (>24hrs) arising from a long haul journey, with a continued expenditure of piglets body reserves. Piglets may compensate for this time off feed by increasing their feed intake upon arrival, as indicated by an increased ADG over the three days following arrival (Fig 3).

In the present study, journey duration had minimal impact on DOA with 0 and 0.08% DOA for short and long journeys respectively. DOA for the remainder of the nursery period was 1% for short journeys and 0.32% for long journeys, indicating overall, there was a lower mortality in piglets transported for long journeys. This suggests that when transported in the right conditions, mortality does not increase with transport duration. Piglet health at the time of transport and management of the piglets in destination barn also influence these results.

Implications

Although all transportation creates some stress for pigs, long haul journeys in summer had a greater impact on piglets, evidenced by greater physiological stress and a larger reduction in ADG upon arrival. Although piglets may show compensation of ADG following arrival; whether there are longer-term consequences of these findings for piglet health is unknown at present.

Research is ongoing in this area looking at the impact of new trailer designs, and on-board watering on piglet physiology, behaviour, welfare and productivity. This will contribute to identifying best management practices for weaner transport for journeys of varying duration.

Acknowledgements

This research was funded by the Agriculture Development Fund Saskatchewan. Thank you to participating industry partners for provision of access to pigs and trailers for collection of data.

References

Sugiharto, S., Hedemann, M.S. and Lauridsen, C. (2014) Plasma metabolic profiles and immune responses of piglets after weaning and challenge with E. coli. J. Ani. Sci. and Biotech., 5:17.

Measuring the prevalence of antimicrobial resistance and pathogens

Bernardo Predicala, PhD,
Prairie Swine Centre

In response to the general concerns about the spread of antimicrobial resistance (AMR) along with increasing public apprehension regarding the use of antibiotics in livestock production, various measures such as the total ban on use of antibiotics in livestock feed and strict regulations on any antibiotic use for treatment of sick animals where implemented in Canada. Another strategy available to producers include adoption of raised without antibiotic (RWA) production practices, wherein appropriate steps are implemented to completely eliminate antibiotic exposure of the pig from gestation to market, without compromising animal welfare. In this work, we seek to answer the question on how effective are these alternative strategies in reducing the total on-farm use of antibiotics, the occurrence of pathogens, and the prevalence of antimicrobial resistance?

To answer these questions, this study conducted longitudinal surveillance monitoring of farms that implemented a RWA program as well as conventional farms using antibiotics as prescribed by a veterinarian (non-RWA). The monitoring strategy focused on three key areas: antibiotics usage, antibiotic resistance, and prevalence of pathogens. Based on the findings, recommendations for best management practices will be developed to help ensure the success of intervention measures such as RWA or other similar alternative production programs.

For this study, we recruited two types of farms to participate in the study: three (3) RWA farms and two (2) non-RWA farms. The overall workflow for the data collection and corresponding analysis to be conducted for this study is shown in Figure 1.

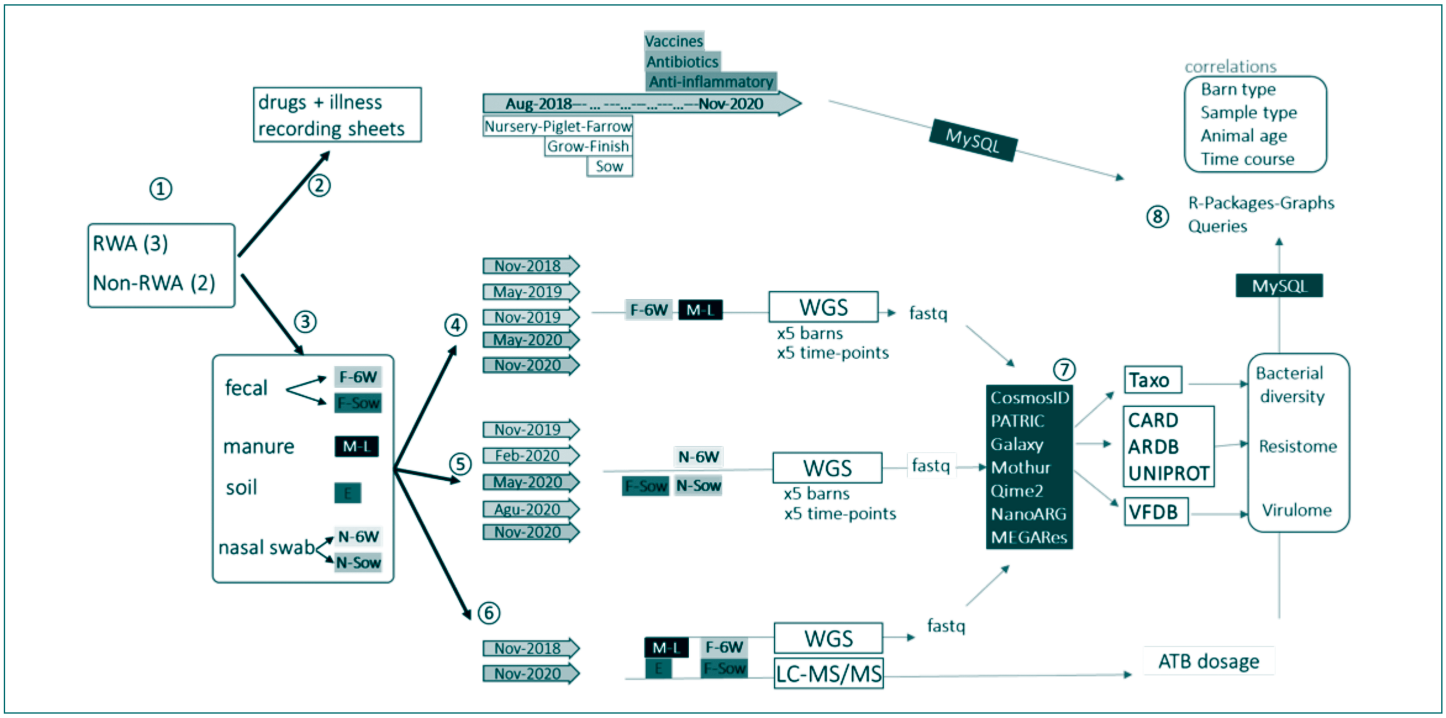


Figure 1. *Diagram of workflow for longitudinal investigation of antibiotic resistance, pathogens and virulence factors associated with pig production. The diagram shows the steps in this project over a 2-year period of sampling and analyses: including sampling and whole-genome sequencing (WGS) strategy for Piglet (6-week-old) fecal material and manure every 6 months, sampling/WGS strategy for Piglet/Sow nasal swabs as well as Sow fecal samples every 3 months ((3,4,5), and first and last sampling time-points for WGS/LC-MS/MS strategy for Piglet/Sow fecal, manure and environmental samples (6). Raw shotgun data are analyzed comparatively through multiple platforms and with open source tools to generate 3 major classes of information: Bacterial Taxonomy, Resistome and Virulome (7).*

Principal Component Analysis
By Attribute: Relative Abundance

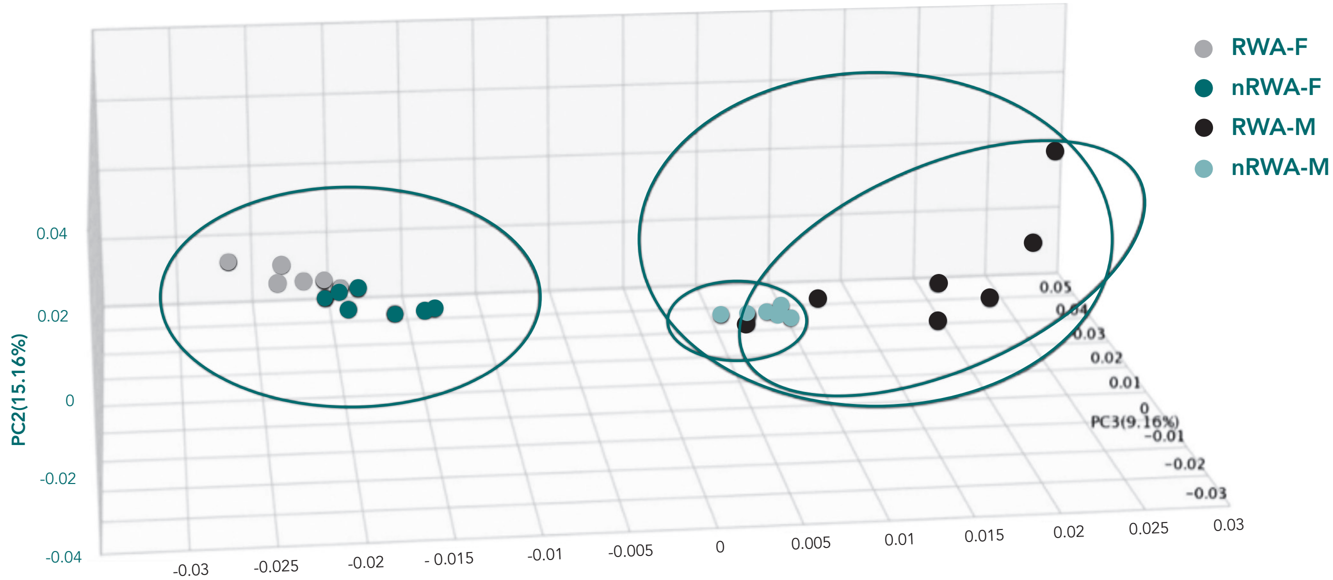


Figure 2: *Statistical analysis of the resistome - beta diversity showing 2 distinct groups: the left ellipse represents the fecal group (containing a non-distinct subgroup of RWA (RWA-F) and non-RWA (nRWA-F)). The right large ellipse represents the Manure group containing 2 close but distinct subgroups of RWA (RWA-M) and non-RWA (nRWA-M).*

Activity 1 – Determining on-farm antibiotic usage patterns and total use

Each participating farm was requested to share their inventory of antibiotics in their barn, and their record of the use of any antibiotics for treatment, including type of drug, dosage, type and number of animal(s) treated and approximate age, treatment cause, location in the barn, and date and time. Typically, producers collect these information as part of the CQA/CPE program, and so we requested for copies of these records every 3 months. Based on these collected data, the total antibiotic use and usage patterns were determined for each participating farm.

Activity 2 – Surveillance monitoring of prevalence of antimicrobial resistance and pathogens

The second activity focused on monitoring the prevalence of antimicrobial resistance and pathogens in each of the participating farms. Representative fecal and manure samples were collected from each farm every 6 months from 6-week, 12-week and 20-week old pigs, and samples from the manure lagoon, and soil samples from the barn's immediate environment were also collected and analyzed. Sampling also included nasal swabs from 6-week old piglets, due to the potential for sequencing analyses to detect/identify subsets of respiratory viruses in addition to virulence factors along with other microorganism categories and their associated AMR.

Results and Discussion

Activity 1 – Determining on-farm antibiotic usage patterns and total use

Preliminary data obtained from the drug treatment records obtained from each participating barn from August 2018 to May 2020 indicate most antibiotics belong to four classes: Antifolates, Blactams, Tetracyclines and Amphenicols. The most prevalent illnesses and treatment reasons recorded included: limping, scours, respiratory impairment and infection. Additional correlation analysis with resistome will determine if these illnesses/symptoms are related to antibiotic classes and whether it leads to any specific set or pattern of resistance genes.

Activity 2 – Surveillance monitoring of prevalence of antimicrobial resistance (AMR) and pathogens

Preliminary beta-diversity analysis of the resistome (statistical analysis between groups of samples) in 26 samples sequenced (three time-points from four barns and one time-point from an additional barn) showed two clusters of clearly-separate groups of type of samples – Fecal and Manure – with respect to the abundance of antimicrobial resistance genes (ARGs) (Figure 2). The Manure group had two close but distinct sub-groups that included the RWA and non-RWA data. Based on the first two time-points of this study, results demonstrate that comparative repeated measures of two ARGs readouts (abundance and frequency) significantly differentiate between RWA and non-RWA groups. For instance, we observed a significant decrease in the relative abundance of Tetracycline-ARGs and multi-drug resistant (MDR)-ARGs in manure samples from RWA barns. We also observed a significant decrease in the frequency of Tetracycline-ARGs in Fecal samples from RWA barns. On the other hand, a greater abundance of the Aminoglycoside-ARG class was observed in RWA barns. However, these observations remain to be confirmed in future sequencing time-points prior to correlation with drug usage trends.

Implications

Preliminary analyses demonstrated a substantial reduction in both MDR-ARGs and Tetracycline-ARGs in RWA barns as compared to non-RWA barns, suggesting that RWA measures can possibly contribute to mitigating the development of resistance to specific antibiotics used in pig production.

Personal Profile

Carley Camire,

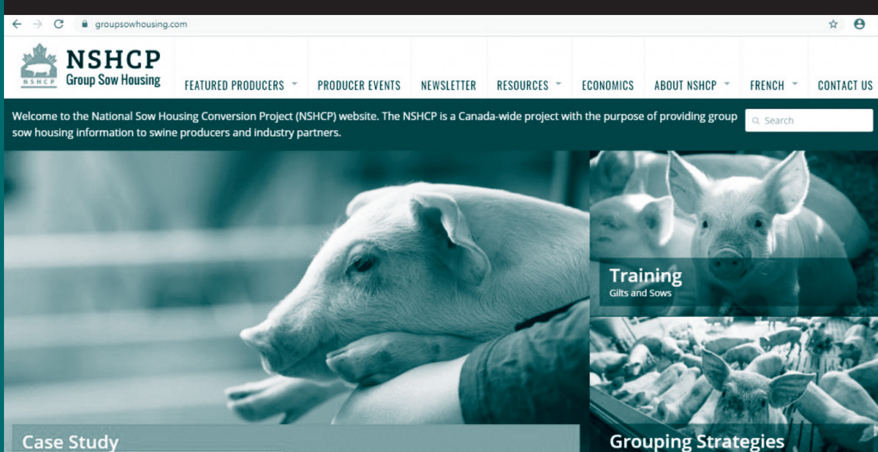
BSc. Masters Student

Carley graduated from the University of Guelph with a BScH in Animal Biology. Originally from Toronto ON, she was able to gain experience working with swine at the Arkell Swine Research Station in Guelph from 2017-2019. There, as well as through nutrition courses at school, she developed a passion for animal nutrition. Carley decided to pursue a master's degree in animal nutrition and will be working under the supervision of Dr. Dan Columbus at the University of Saskatchewan. Her project will focus on "The role of dietary nitrogen in improving amino acid utilization" with the ultimate goal of meeting amino acid requirements through the use of dietary nitrogen in low-protein diets to maximize efficiency and optimize growth performance while reducing the environmental impact. After completion of her master's, Carley would like to continue with swine nutrition research while working towards her PhD in the hopes of becoming an animal nutritionist in industry and/or in academia.

Coming Events

LE PORC SHOW
November 25, December 3 and 9, 2020
FREE 3-day Virtual Event
Visit leporcshow.com for more information

BANFF PORK SEMINAR
JANUARY 5 & 7, 2021
FREE 2-day Virtual Event.
Visit banffpork.ca for more information



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Centred on Swine is a semi-annual newsletter produced by Prairie Swine Centre Inc. (PSCI).

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