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Learning from industry – closing the knowledge loop

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This issue of Centred on Swine is dedicated to the people that make it possible to have Prairie Swine Centre respond to and tackle the ever- changing challenges of the Canadian pork industry – pork producers and their agencies. This group has an unfailing faith in the future and the role of science to assist in developing new answers. This faith has brought governments and multiple individual businesses together to support the work of our Centre. Through this publication, our various digital media, and of course personal interaction with our staff and students we seek to improve the profitability and sustainability of the Canadian pork value chain for the benefit of its stakeholders and the pig.

Our vision, which started 25 years ago, was to differentiate Prairie Swine Centre's approach to science focusing on the delivery of knowledge that can improve both the cost of production and sustainability of Canadian pork farms. Our commitment is to turn science into knowledge that

(Learning from industry...Cont'd on pg. 11)

Publication # 40010021

Assessing Cleanliness of Swine Transportation Trailers

Bernardo Predicala, Ph.D.

Alvin Alvardo, M.Sc.

Visual inspection of newly cleaned trailers is not sufficient in assessing trailer cleanliness

Pig transportation is widely recognized as a significant risk for transmission of swine diseases. With the outbreaks of Porcine Epidemic Diarrhea (PEDv) and the potential for PRRS, a great deal of effort has been put forth to ensure transport trailers are properly washed, disinfected and inspected for organic matter and microbial contamination prior to use. Typically, visual inspection is carried out to assess the cleanliness of trailers after washing/disinfection/drying procedure, supplemented by microbiological testing using the culture method (CSHB, 2011) in certain situations.

However, work at the Prairie Swine Centre has found visual inspection to be not consistent or very reliable assessment. While traditional microbiological culture method involves the use of plated media which need to be incubated and analyzed to obtain an indication of the contamination of the sampled surfaces. Also relies heavily on the quality control process of sampling and analysis. This can cause significant down-time for trailer operation, and delays implementation of corrective actions while waiting for test results. Work led by Dr. Bernardo Predicala, at the Prairie Swine Centre set out to find an alternative reliable, rapid and easy to use means of monitoring surface cleanliness of swine transport trailers.

Over the last decade, the ATP method (adenosine triphosphate bioluminescence) has been used in other industries (food, hospitals, cattle) for monitoring surface cleanliness and microbial contamination, the opportunity of the ATP method was explored for practical application within the pork industry. This particular method uses bioluminescence as an indicator of the level of residual ATP present on swabbed surfaces. Once a surface is swabbed, the sample is exposed to an ATP-releasing agent (lysis buffer) and an ATP-activated light-producing substrate and enzyme (luciferin and luciferase). The amount of ATP present on the tested surfaces can then be quantified by the amount of light emitted

during the enzymatic reaction (in terms of relative luminescence units, RLU). The intensity of light is proportional to the amount of ATP and the degree of contamination.

Samples were taken from dry, cleaned trailers using an ATP swab by swabbing an area of 10 cm x 10 cm in multiple locations in the trailer and were tested for microbial contamination level using an ATP bioluminescence meter. Results obtained from ATP testing were compared to the co-located samples taken using standard microbiological techniques with MacConkey and R2A agar contact plates (diameter = 60 mm). From a total of more than 500 samples (for each method) collected from 18 commercial swine transport trailers across Saskatchewan, a moderate correlation was found between ATP bioluminescence method and standard microbiological technique using R2A agar plates. Poor correlation, however, was found between ATP method and MacConkey agar plate counts. Unlike R2A that detects a wider group of bacteria, MacConkey agar supports only the growth of selected Gram-negative bacteria while ATP bioluminescence detects ATP from both microbial and organic sources. Threshold values in assessing the effectiveness of swine transport trailer cleaning protocol using ATP bioluminescence method were established with 570 RLU per 100 cm2 and below as 'Pass' while 800 RLU per 100 cm2 and above as 'Fail' or has high risk of disease propagation.

The benefit of the ATP method is the ability to provide results within minutes, as opposed to a number of days for traditional microbiological testing, making ATP bioluminescence a good alternative for quick monitoring of surface cleanliness of transport trailers.

Take Home Messages:

- ATP bioluminescence method can be used as a tool for rapid assessment of surface cleanliness of swine transport trailers, complementing the procedures.
- Dirty areas in trailers can be conveniently and rapidly identified using ATP method, and corrective actions on the current washing/disinfection protocol can be made.
- Visual inspection of newly-cleaned transport trailers is not sufficient in assessing surface cleanliness.
- Trailer floors posed the highest risk of microbial contamination among the six critical areas tested.

Table 1. Threshold values in assessing effectiveness of swine transport trailer washing/disinfection/ drying protocol using MCA, ATP bioluminescence and R2A

Assessment criteria from CSHB, 2011			*Threshold Values*	
Category	*Remarks*	*MacConkey*	*ATP agar[a]*	*R2A agar[c] bioluminescence[b]*
Pass	*Maintain wash, disinfection. and drying protocols*	*0 – 10*	*0 – 430*	*0 – 140*
Critical	*Risk of disease propagation, . improve protocols. Room for improvement*	*11 – 50*	*431 – 850*	*141 – 625*
Fail	*High risk of disease propagation. Identify problem and correct the wash, disinfect and drying protocol and its observance.*	*>50*	*>850*	*>625*

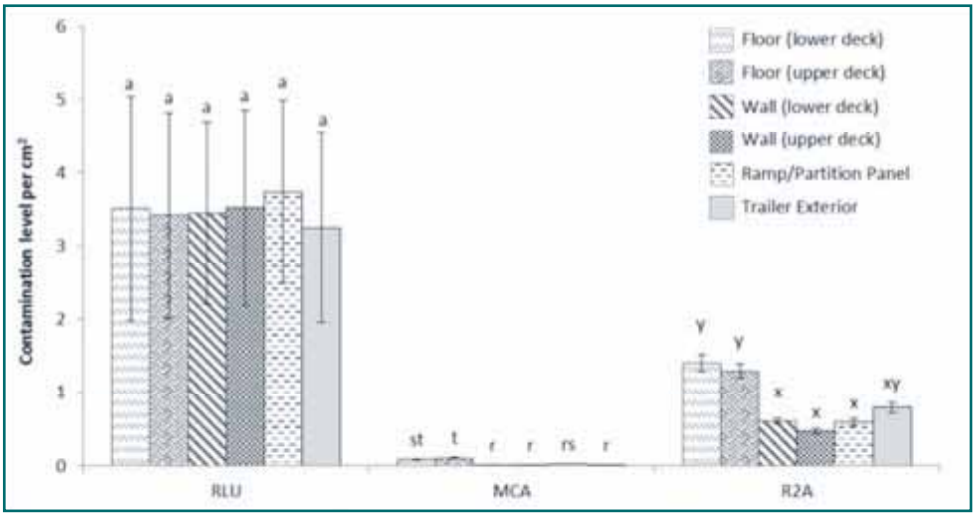


Figure 1. Mean (±SE) contamination levels (n = 16) of different sampling locations in the trailers as detected by the ATP bioluminescence meter (in RLU per cm2), and MCA and R2A agar plates (in CFU per cm2). Means with the same letters are not significantly different (p>0.05).

Estimate of cost for testing a two-deck swine trailer:

Number of locations: 6

Number of samples per location: 2

Number of samples per trailer: 12

Microbial Culture Method (MCA/R2A):

at $6.73 per contact plate

a. In-house incubation and counting: cost is ~$80/trailer (+ incubator ~$500)

b. Commercial lab (incubation and counting): ~$480/trailer (+ shipping)

ATP Bioluminescence: at $3.72 per swab, cost is ~$45/trailer

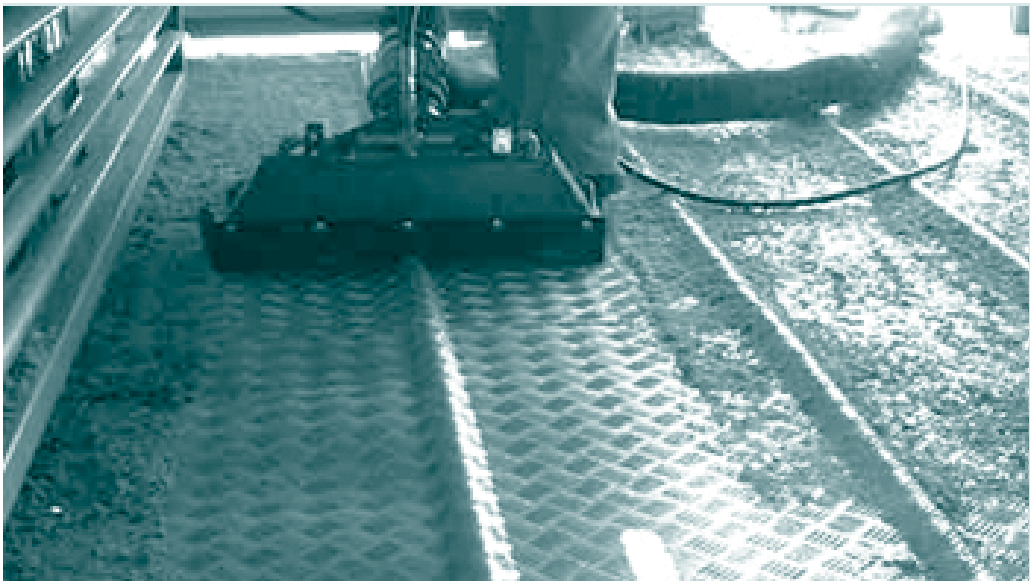
(+ ATP luminometer ~$2,000)

Note: in both cases, user conducts the sample collection on the trailer (labour cost not included).

Improving biosecurity in swine transport

Sarah Ethier

Jennifer Brown, Ph.D.



As pork producers watched the spread of PEDv in North America in the summer and winter of 2014, it became increasingly apparent that even when good on-farm biosecurity procedures are in place, there may be serious gaps in biosecurity, particularly related to transportation. Transport of pigs can be a major vector for disease transmission in swine, and improved sanitation can be a key component in reducing disease transmission. The need for better cleaning and sanitizing procedures, and development of easier to clean trailers for the swine industry has become clear, both to reduce the spread of PEDv, and to control other potential disease risks. A number of problems have been identified which hinder the efficient and thorough cleaning of trailers currently being used within the industry. These include a limited number of (hog) transport trailers available, downtime required between loads, and capacity of truck wash facilities. In addition, current trailer designs are difficult to clean, requiring the use of manual labor which increases cost, and potentially leading to problems with cleaning consistency.

The initial phase of the project investigated current trailer designs used in Canada and ranked relative trailer attributes related to animal welfare and ease of cleaning. Information collected from this phase was analyzed with trailers being ranked according to ease of cleaning and animal handling followed by recommendations for improvement in both areas. This information provided will also be used as a basis for the development of an automated cleaning system.

Trailer Design

Trailers used by the Canadian swine industry for transporting market hogs feature manufacturers Wilson, Barrett, Merritt and Eby. One transporter, Luckheart transport in Ontario, has recently begun importing Pezzaioli trailers from Italy. In western Canada, the majority of trailers used for market hog transport are dual purpose cattle and hog trailers with a tandem or triaxle spread. These specific trailers are popular due to standard features such as cleaning ease, durability and individual manufacturer's willingness to customize livestock trailers based on requests of drivers and dealers.

The most commonly used trailer design is a double deck potbelly trailer with a belly rail installed between the pot and top deck. Removable flooring is inserted in the middle deck in order to convert the trailer from a double to triple deck design (two decks for transporting cattle, three decks for pigs).

Other commonly used trailer designs include straight deck trailers for transporting market hogs and quad deck trailers which are used exclusively for transporting isowean piglets. In Ontario, Luckhart Transport Inc is working to introduce the Pezzaioli livestock trailer which is manufactured in Italy. The Pezzaioli trailer features flat hydraulic floors, no ramps or step-ups, active ventilation (fans), misters and heated drinkers (nipple drinkers for pigs and bowl drinkers for cattle). These trailers are specifically designed to meet EU transport regulations which require the provision of food and water on all transports longer than 8 hours.

Ease of Cleaning

In general, straight deck trailers have been ranked as the overall easiest to clean due to presence of fewer complex floor surfaces and greater head room, while quad deck trailers (used for isowean transport) are rated as the most difficult to clean. As the amount of removable

decking increases in a trailer the process of cleaning becomes more difficult and greatly increases the amount of labour required to clean the trailer.

The average trailer takes approximately 5.5 man hours to clean, and usually consists of 2 employees working together to complete a full trailer wash and disinfection. The more material in a trailer the longer to wash, this means a quad deck trailer can take up to 6.5 hours to complete, especially since the floor needs to be removed in order to be adequately washed

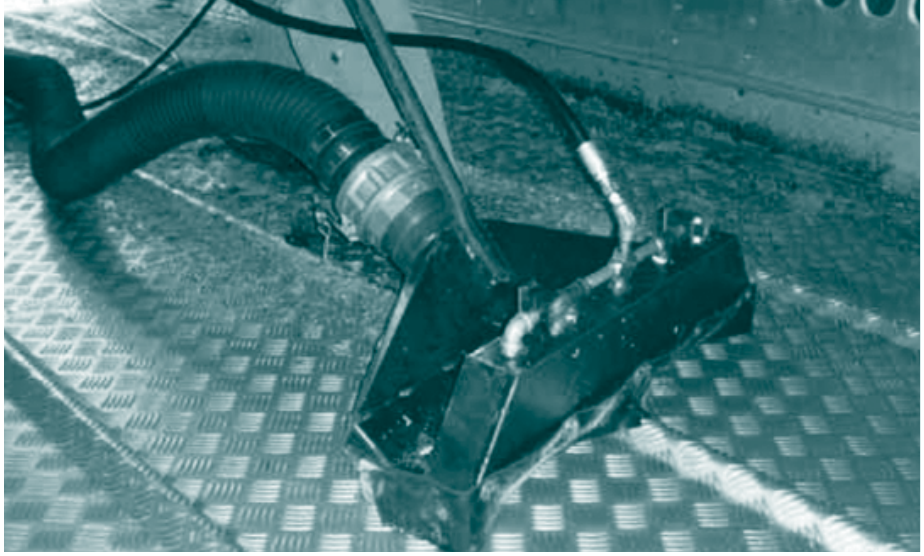
Various aspects of livestock trailers impact the overall cleaning ease of trailers due to subtle changes in trailer design. Key factors that influence the ease of manual cleaning include:

i. **Floor plan.** Straight decks are simpler to clean than pot trailers which have multiple ramps and floor surfaces.
ii. **Flooring type and pattern.** Removable decking increases the flexibility of trailer use, but must be completely removed for proper cleaning. Smooth floors are easier to clean, but texture (eg checker plate) and cleats provide animals with more secure footing.
iii. **Support beams.** Some beams are encased, whereas others are open I-beams which collect dirt on side ledges.
iv. **Deck height.** Low ceilings make cleaning difficult, as cleaners need to bend over to access the compartment.
v. **Design of fixtures.** Sealed lights and tubing, angled gating, conveniently placed and easy to clean gate latches reduce buildup of organic matter and facilitate cleaning.
vi. **Access doors and drains.** Placement of doors and drains that are well placed and easily flushed.

Animal Handling

Stress associated with handling and transport can lead to heat stress, heart failure and high levels of stress. Particularly on hot summer days, heart failure can occur in pigs moving up ramps, or following strenuous exercise associated with mixing and handling. There are many trailer features which affect difficulty the loading and unloading of market hogs, as well as their comfort during travel and risk of injury due to trapping, pinching or impact with trailer components.

i. Ramp design. Number of ramps, ramp length, angle and surface (cleat height and spacing).
ii. Loading density.
iii. Head height. Handlers
iv. Protrusions. Sharp corners and edges, and ribbing on walls or floors can cause bruising.



v. Pen layout. Turns and distance travelled to each compartment.
vi. Flooring. Adequate ribbing to minimize slipping. Removable decks are typically smoother than permanent flooring.
vii. Gates and ramps. Crevices where feet or other body parts may be trapped. Temperature control. Hot or cold areas vary with season, ambient temperature, compartment (air flow/ventilation/boarding/bedding/contact with cold metal)
viii. Suspension and vibration. Previous research suggests that suspension in the rear of the trailer may cause greater bounce in these compartments. Pigs were more reluctant to lie, and spent more time standing in rear compartments.

One of the difficulties in ranking specific trailer models for animal handling and welfare is the ability to customize trailer design. Transporters have the option to customize trailers to their preference by pre- or post- market modifications. Two trailers from the same manufacturer and of the same design may have different features which impact animal handling within the trailer.

Retrofit opportunities to improve animal welfare and ease of cleaning:

Due to multiple trailer types and configurations retrofitting trailers to increase ease of cleaning an animal welfare need to be considered on a trailer by trailer basis. However there are several key recommendations that should be considered in the development phase of any trailer use for the transport of hogs.

> In terms of ease of cleaning, the general rule is that trailers with more decks take longer to clean

One of the main features which pose a difficulty to hogs during loading and unloading is the number of ramps within a trailer, as an increased number of ramps and angle of ramps makes loading hogs more difficult. The maximum recommended ramp angle for market hogs is 20° (Canadian Agri-Food Research Council, 2001); however, hogs can navigate ramps with gentle slopes more easily than severe slopes. Through the use of hydraulic floors, Pezzaioli trailers have avoided the need for any ramps, making it especially welfare friendly.

Features to improve cleaning ease:

- Decrease the amount of removable decking
- Decrease the number of ramps
- Have fewer tight corners and enclosed spaces
- Avoid open ended tubing, I beams, ledges and fixtures that trap debris
- Have well placed and designed access doors and flush out openings

(Improving biosecurity...Cont'd on page 9)

Assessing Particle Size and the Cost of Grinding

~~Danilo Sotto,~~
~~Tom Scott and~~
~~Denise Beaulieu~~

Particle size reduction improves feed efficiency in all stages of the production cycle in pigs. Based on studies by researchers at Kansas State University (KSU), an average particle size of 700 to 800 microns (um) is recommended. However, this recommendation is based on studies conducted using corn-soybean meal based diets. To our knowledge, there is no information on the effect of particle size in wheat and barley-based diets from on-farm mills in Western Canada. This presents an opportunity to improve animal performance and income for producers by improving our understanding of particle size under regional conditions. Feed and ground grain samples from 1 toll mill facility and 4 on-farm mills (2 Alberta and 2 Saskatchewan) were collected and analyzed for average particle size to establish the variability among mills. Hammer mill was the most common type of mill, with all but one of the participants using this grinding system.

Particle Size Variability

Particle size in samples of wheat ranged from 697 to 889 um and averaged 795 um. On average, wheat was ground within standards set by the Kansas State University (700 to 800 um using corn-soybean meal-based diets) while barley particle size was slightly coarser, but within acceptable variation limits (+ 10%). Particle size of complete feeds, from two of the farms sampled, were higher than KSU recommendations indicating possible losses in terms of feed efficiency. Variability in diet particle size was possibly due to the type of primary grain used, other ingredients, and their proportion in the overall formulation. All farms were aware of the benefits of particle size reduction in improving feed efficiency; however none of the participants had a quality control program in place to monitor particle size.

Flow-ability

A majority of the participants cited reduced flowability when grinding grains (or diets) to a smaller particle size, with finely ground diets creating greater issues within the mill and feeding systems. However, results suggest that bulk density, fat content and their interaction with particle size may also have an impact on flowability within the feeding system. Regardless of particle size, wheat and wheat-based diets flowed better than barley and barley-based diets.

Table 1. Average particle size of swine diets from on-farm mills in Saskatchewan and Alberta.

Location	Grinder	No. of feed types sampled	Annual feed production, tonnes	Average particle size (dgw), um		
Saskatchewan	Hammer mill	7	9,600	904	(851-945)	a
Saskatchewan	Hammer mill	6	4,000	906	(831-968)	a
Saskatchewan	Hammer mill	2	35,000	732	(728-737)	b
Alberta	Hammer mill	2	3,780	697	(676-717)	b
Alberta	Disk mill	6	5,600	749	(657-795)	b
			57,980			
P-value				<.0001		

Grinding Efficiency

The second phase of the project utilized five individual sources of wheat and barley, each ground to an average particle size of 550, 700 and 850 um using either a hammer or a roller mill to determine the effect of grain type (wheat vs. barley), grinder type particle size and their interactions on grinding cost, and particle and handling characteristics of ground grains.

Results show that production rate (tonnes per hour ,TPH) was 45% higher when grinding wheat compared to barley. Grinding grains using the roller mill resulted in 14% higher production rate compared to hammer mill. Regardless of grain and type of grinder, there was a significant linear decrease in production rate (5.02 to 4.01 TPH) when grinding grains from 850 to 550 um. With current power costs (2016), grinding barley using the hammer mill resulted in a higher power consumption (3.39kWh/t) compared to wheat, consequently increasing the grinding cost of barley by $0.36/tonne (Fig. 1). Regardless of particle size, grinding cost between wheat and barley was similar when a roller mill was used.

Grinding barley using a hammer mill had the highest grinding cost

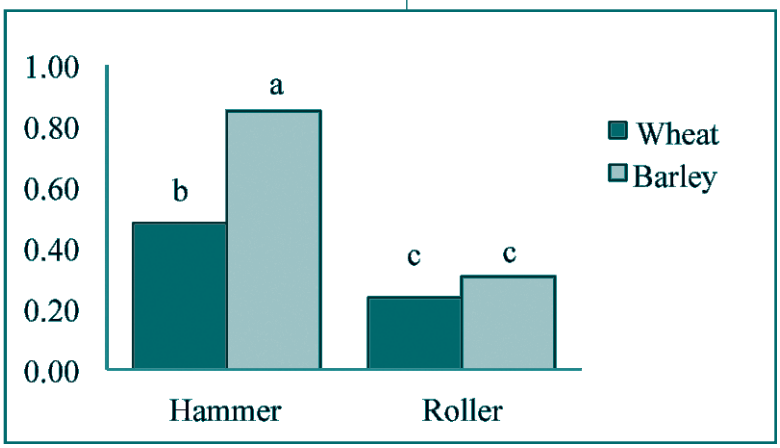


Fig. 1. Effect of grain and grinder on grinding cost, $/tonne.

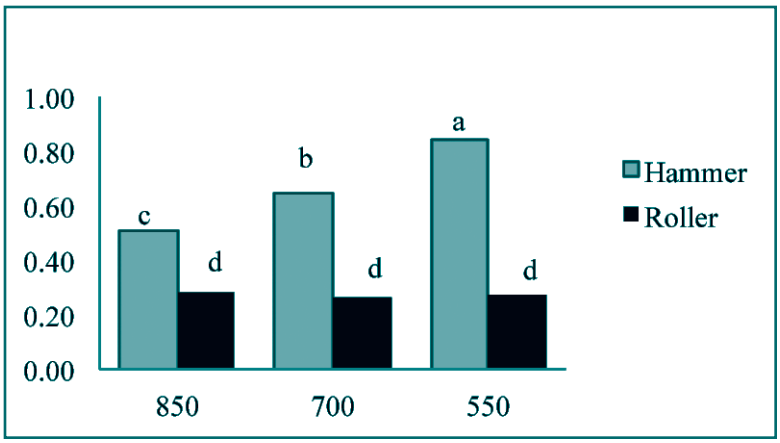


Fig. 2. Particle size and grinder on grinding cost, $/tonne

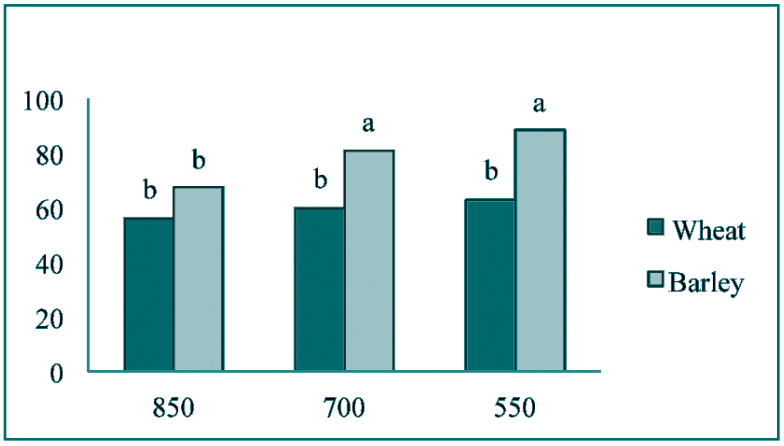


Fig. 3. Effect of grain and particle size on emptying angle of repose.

Grinding grains from 850 to 550 um using the hammer mill increased power consumption by 3.17 kWh/t resulting in $0.34/tonne increase in grinding cost. However, there were no differences in power consumption and grinding cost when reducing the particle size of grains using the roller mill (Fig. 2). Reducing the particle size of barley from 850 to 550 um significantly reduced its flowability (Fig. 3).

Implications

Grinding barley from 850 to 550 um using the hammer mill had the highest grinding cost, ranging from $0.64 - $1.05/mt. Using this information and assuming a feed efficiency improvement of 1.3% for every 100 um reduction in particle size for barley based diets, a net savings of $7.80/pig in total feed cost may be achieved just by reducing the particle size of barley by 300 um . To address flowability issues associated with grinding finely, finding the optimum ratio between wheat and barley may address this issue because wheat is more flowable than barley even at lower particle size.

Assessing Enrichment for Sows

Victora Kyeiwaa, B.Sc., Jennifer Brown, Ph.D.

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

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

Funded by Agriculture and Agri-Food Canada (AAFC) and is part of a larger Swine Innovation Porc project (led by Dr. Laurie Connor at the University of Manitoba, with the research being carried at Prairie Swine Centre and the University of Manitoba), this project examines different methods of developing effective environmental enrichment for group-housed sows which would be economically viable to the pig industry and could serve to guide producers in decision making.

European research has identified straw and other malleable and consumable materials as being optimal for pigs. However, in North America there is a greater reluctance to provide such materials. Straw has been shown to be effective in grower-finisher pigs, but many producers feel there may be an increased risk to biosecurity by bringing straw into their facilities. Small amounts of high fibre materials (e,g, chopped or pelletized straw) can be provided, in a rack or hopper, for example, and will increase satiety (feeding satisfaction) in sows as well as providing enrichment.

Providing enrichment can help to reduce aggression and stress and improve physiological function for all ages of animals, providing a direct benefit to pork producers, along with addressing public concerns regarding barren conditions in housing facilities.

Sows in stalls show stereotypies or abnormal behaviours such as bar biting, continuous drinking and vacuum/sham chewing. Stereotypies are defined as behaviours with no clear function, and are seen as indicators of frustration, boredom, fear and stress. Sows in group housing also show some of these abnormal behaviours, especially ear/tail-biting, bar biting, as well as overt aggression, which can increase the chance of abortions.

What Types of Enrichment Do Sows Prefer?

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

Older animals generally prefer manipulable and destructible enrichments

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

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

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

While the benefits of enrichment are well known, determining exactly what enrichments are suitable at each stage of production, as well as the best methods for presenting them are still unclear. This research will help to fill these gaps related to sows, and will form the basis for practical recommendations to benefit sows and help producers meet the code of practice requirement. Enrichment is a new area for Canadian pig producers, and time is needed to clarify what is meant by enrichment and to implement these measures.

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

(Improving biosecurity...Cont'd from page 5)

Features to improve animal handling and pig welfare:

- Decrease the number of ramps, and floor levels
- Reduce the amount of loose equipment (chains, pins, etc)
- Reduce sharp edges or protrusions and areas where body parts may be trapped or pinched
- Increase door width
- Decrease the slope of ramps and minimize step ups
- Handle pigs using behavioural principles (approach and retreat, use of flight zone) in a low stress manner (use prods only when needed)
- Have adequate ceiling heights during handling
- Forced ventilation in summer, and bedding/ insulation in winter
- Use sprinklers at loading and unloading (temperatures ≥24°C)

"Due to multiple trailer types and configurations retrofitting trailers to increase ease of cleaning and animal welfare need to be considered on a trailer by trailer basis."

Summary

Although many livestock trailers may look very similar at first glance, there are in fact a wide variety of designs in use. Individual manufacturers offer a variety of options on trailers, and transporters often do aftermarket custom work, making it difficult to define the exact features present on an average livestock trailer. These include variations in trailer siding, ramp length and angle, step design, light housing, gating, latches, sprinklers or misters as well as other features.

In terms of ease of cleaning, the general rule is that trailers with more decks take longer to clean, and that flat deck trailers are easier to clean than pot trailers. The new hydraulic deck trailers fit between these categories, as while the decks themselves are relatively easy to clean, the chain drive, locks and controls are all complex components and difficult to clean thoroughly.

Animal handling is clearly improved on straight deck trailers as the use of ramps is minimized. Handling of pigs on hydraulic deck trailers is even better as there are no ramps involved. However, pot belly trailers (either dual purpose or dedicated for pig transport) remain the most commonly used trailer design in Canada. These trailers (especially dual purpose ones) are highly versatile, have high load capacity and are relatively low weight. However, these trailers are also the most difficult to clean and have poorest animal handling characteristics. Alternative designs are being used which are easier to clean and allow better ease of handling for animals, but these designs are less versatile, have reduced load capacity and/or are significantly heavier.

The trucking industry recognizes the need for innovation in this area, especially due to increased biosecurity concerns and the cost of cleaning trailers, however this change will come at a cost due to reduced capacity, less versatility, higher trailer weight and higher purchase cost. Regardless of these issues, improved technologies to aid in the cleaning process will assist the industry regardless of trailer design and are sorely needed.

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

Reducing Temperature Requirements for Group Housed Sows to Save Cost

Alvin Alvardo. M.Sc.

Bernardo Predicala, Ph.D.

Work at Prairie Swine Centre indicates that sows in group housing systems will maintain room temperatures between 9 to 12 °C, leading to approximately 78% reduction in energy consumption when compared to gestation rooms maintained at pre-set temperature of 16.5 °C.

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

> Average temperature was considerably lower with sows fed the high heat increment diet

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

It has been widely thought that sows housed in groups may have LCT values significantly lower than 15°C when given the ability to utilize behavior such as huddling. If group-housed sows can maintain body condition and weight gain at temperatures lower than currently maintained in sow barns without the need for additional feed, the potential exists to significantly reduce energy costs for heating and ventilation, reducing the overall cost of production. Currently, energy/utility costs rank third in total cost of production, only behind feed and labour cost.

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

Dietary fiber increases heat production in sows without increasing digestible energy. As such, adding fiber to the diet can be a means of reducing activity and limiting aggression in sows under reduced barn temperature. The addition of fiber to the diet could be a means of addressing

behavioral issues associated with grouped-sows as well as contributing to the energy balance of sows under reduced barn temperature.

What temperatures do group-housed sows prefer?

The project consisted of two phases of experiments; the first phase utilized environmental chambers followed by tests in actual group-housed gestation rooms. Results from the first phase of the study indicated that throughout the trial a pattern was observed where temperature changes occur mainly during the day when sows are mostly active, as barn operations were carried out (between 7 AM-3 PM) ; beyond this period, lights in both chambers are turned off. Room temperatures at the time sows activated the operant mechanism was also recorded. Average temperature when the operant mechanism was activated was considerably lower at 12.5°C for the sows fed with high heat-increment (high fibre) diet. This suggests the sows could tolerate lower temperatures before calling for supplemental heat compared to sows fed with standard gestation diet.

In terms of performance, sows fed with standard gestation diet had an ADG of 0.16 kg/day on average over the trial period. While sows fed with high heat-increment diet were able to tolerate lower temperatures and performed slightly better with average ADG of 0.20 kg/day.

Phase 2

The second phase of the project configured two barn rooms for group housing, with each room housing 28 gestating sows. One room was operated at a typical set-point temperature (16.5°C) while an operant mechanism was installed in the other room, allowing the sows to control the temperature. Similar to Phase 1, temperature fluctuations occurred mainly during the day (7AM-3PM) when sows are mostly active and when the actual switch presses occurred. Preliminary results for Phase 2 of the project have shown that sows could tolerate temperature lower than the typical 16.5°C set-point maintained in gestation barns with sows maintaining temperatures about 5 °C lower than in a pre-set room, leading to about 78% reduction in energy consumption. At current energy prices, this 78% reduction in energy consumption would improve the producers' profitability by more than $5.00/hog during the heating season.

(Learning from industry...Cont'd from pg. 1)

the industry can readily access, interpret and apply. Articles you see in Centred on Swine come from PSC research teams and are often in collaboration with Scientists who have developed unique skill sets from facilities located in Canada and throughout the world. These partnerships give the Canadian industry an edge by providing timely and reliable information that can be used by the barn manager, the transporter, the packer and the suppliers.

I want to focus on just a few recent initiatives that help to explain how our Centre turns science into knowledge then supports this knowledge through demonstration to hasten adoption by industry. The cycle continues when industry participates in and gives back its experience and the knowledge pool grows which further encourages adoption.

• The National Sow Housing Conversion Project. This started with a vision to take the knowledge developed by research and pair that with on-farm building and swine management expertise. The result would be, and is, a series of barn conversions that successfully use the growing knowledge pool to demonstrate that these conversions from stalls to groups can be accomplished successfully in a variety of farm situations. The result is improved design of space to meet the needs of the sow, maintaining or enhancing productivity for the farm and boosting the confidence of individual pork producers to invest in new systems and technologies.

• Transportation of animals of all sizes is integral to pork production in Canada. For more than 10 years the Centre has pursued collaborative projects on the effects of transport on the pig and meat quality. The outcome has been an improved understanding of the transport environment and how the pig responds. The work continues with advances in specialized trailer design that addresses biosecurity, animal welfare and ease of handling.

• The area of nutrition is a benchmark of being at the leading edge of picking up new technologies. Having demonstration and research projects that gather on-farm data includes; a 'blue dye technique' for determining eating behavior of nursing piglets; recently a grinding and particle size evaluation study that confirmed we are not optimizing performance with our on-farm milling systems; and demonstration of feed cost savings through allowing the lactating sow to determine her daily feed needs.

For 25 years Prairie Swine Centre's approach has focused on the delivery of knowledge to the pork industry

• A newly-funded collaborative initiative between Prairie Swine Centre, Centre de developpment du porc du Quebec, and Swine Innovation Porc will focus on the financial benefits of adopting new research on pork farms across Canada in 2016-2018.

Closing the loop by engaging innovative pork producers to work with researchers for the purpose of demonstrating the effectiveness of new technologies on-farm is an important way to speed adoption and improve the competitiveness of the whole sector.

I end this article by pointing you in the direction of our most recent publication, the 2016 Annual Research Report. In that publication my President's Report highlighted the following:

World-class research organizations don't just happen, they are the culmination of seeking out research scientists that have a passion for progress and share a vision of how science can make a contribution to the Centre's mandate. Although strong science is at the centre of a research institute it is just the beginning. The full team of staff must be pulling in the same direction, which can be a challenge because science by its nature is based in discovery and the outcome isn't known. So, research centres have that juxtaposition within their DNA. That is: 1) To perform as an innovative knowledge developer; while 2) managing production systems and a workplace expectation that seeks stability and regularity.

Dr. Jim Brandle, CEO of Vineland Research and Innovation Centre summed it up succinctly in their Centre's 2014 Innovation Report:

World-class research organizations don't just happen. They're the result of great science, innovative thinking, strong local and global partnerships and sheer tenacity. — J. Brandle, CEO, Vineland Research and Innovation Centre.

Personal Profiles

Michael Wellington

Michael Wellington is a Ph.D. student at University of Saskatchewan under the supervision of Dr. Andrew Van Kessel (Department of Animal and Poultry Science) and Dr. Dan Columbus (Prairie Swine Centre Inc.). His research focuses on examining the effects of high dietary fibre and immune challenge on threonine requirements and robustness of grower pigs. Michael is originally from Accra, Ghana and obtained his BSc. (Hons) Agriculture with a major in Animal Science from the University of Ghana in 2012. He then served as a teaching and research assistant at the Department of Animal Science (from Sept 2012- June 2013). He worked as a technical sales officer with Maridav Ghana limited from July 2013 until July 2014.

In August of 2014, he then started a Master's Degree program under the Erasmus mundus European Union scholarship at the Swedish University Agricultural sciences and the University of Copenhagen. He completed his MSc studies in August 2016 obtaining a double degree master in Animal Science. His MSc research focused on nutritional strategies to improve growth performance, reduce antibiotic use and improve meat product quality using the guinea pig as a meat animal model. Michael is training as PhD to have advanced knowledge and research skills in swine nutrition and gut health/function.

Looking Back

PRAIRIE SWINE CENTRE | 25 YEARS

PSC Advisory Board
Back Row: Vic Pouteaux, Dennis Hodgkinson, Garth Larson, Don Lidster, Dr. Harold Fast
Front Row: Dr. Phil Wilson, Dr. John Patience, Ray Price, Dr. Al Theede

Coming Events

Banff Pork Seminar
January 10-12, 2017
Banff, AB

Manitoba Swine Seminar
February 3-4, 2017
Winnipeg, MB

London Swine Conference
March 28-29, 2017
London, ON

World Pork Expo
June 7-9, 2017
Des Moines, IA.

Alberta Pork Congress
June 14-15, 2017
Red Deer, AB

PRAIRIE SWINE CENTRE

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