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# Finding New Technologies in the Pork Industry



Lee Whittington,  
 BSc(Agr), MBA, PAg  
 President/CEO,

at the heart of how we will assess what we need and what will become available to us in pork production.

The source of advancement in Precision Farming is based on access to lower-cost data collection devices and the moving of this data through the Internet of Things network of devices and storage. To make these two themes useful for Canada's pork producers we will explore individual projects that exist because of these two data phenomena. I will balance these advancements with other more 'tangible' technologies that are moving out of the lab in the next few years.

The term "Precision Farming" is used, especially in arable agriculture, to describe the collection of data in the field and the judicious use of expensive inputs to improve net income, reduce waste and impact on environment (sustainability), and speed (even automate some) decisions. From my perspective what will determine the success of any of these ideas will be their ability to use them in a barn environment (must be robust), and they must address a fundamental business need of collecting, analyzing and acting on aspects of production that have economic value.

The use of new Precision Farming technology is so prolific within arable farming that there are companies and newsletters devoted to the subject. The Top 10 Technologies are discussed in one publication <https://www.therobotreport.com/top-10-technologies-in-precision-agriculture/>. A review of the article reveals that most of the topics are not easily translated into animal agriculture: GPS; Mobile Devices; Robotics; Irrigation; Internet of Things; Sensors; Variable seeding rates; Weather modeling; Nitrogen modeling; Standardization. Some however, are important and relevant, such as mobile devices, Internet of Things, and standardization as they are



**Beginning outside the barn:**

Geofencing and syndromic health surveillance are now possible with satellite technology that allows the technology to draw a 'fence' around a building or property and link this through an app that can record the movement of people (or devices with the app) across the 'fence'. As part of the biosecurity of the farm - Be Seen Be Safe, a Guelph, ON based company is using this technology to create notification to the farm manager, an alert to

*(Finding New Technologies... cont'd on page 3)*

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# On-Farm Biosecurity

## Auditing Best Management Practices

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*In 2017, on-farm best management practices were audited on a total of 24 farms throughout Canada as part of a national project titled From Innovation to Adoption: On-farm Demonstration of Swine Research. This article is part of an eight-part series reporting on these audits.*

It is easy to take biosecurity for granted, that is until something goes wrong in the production unit. The resurfacing of PEDv throughout the spring (2017) in Manitoba reinforces the importance of daily procedures and facility layout that keep Canadian herds healthy.

Overall results of the audits indicate that producers across Canada place a great deal of importance on biosecurity within their operations. It is important to note that a majority of the audits took place prior to the PEDv outbreak in Manitoba (2017), indicating that biosecurity has always been a key element in successful pork production.

### Key indicators include:

- All but one of the participating farms have only one source of animals entering their facilities.
- More than 80% of audited farms have adopted biosecurity procedures, including taking a shower and providing a change clothes and boots before entering a barn. Typically, if producers did not meet this requirement, it was due to limitations associated with the age of the facility and associated renovations.
- All participating farms ensured that staff were properly trained regarding biosecurity protocols, with a vast majority of the farms (92%) reviewing them annually.

### Potential areas of improvement:

- Most farms know the importance of a visitor registry. Results from the audit, however, indicate that just over half of the farm registries were up to date at the time of the audit. While this is a simple step in the audit process, it can be one that is easily overlooked and can be exceedingly important at times of a disease challenge.
- Protocols for entering or exiting the building are posted and respected in approximately two-thirds of participating farms. In digging deeper into this question, farm managers agree that biosecurity procedures are respected by staff and visitors. However, in one-third of the farms audited, proper signage related to biosecurity was lacking on and within the production site.

Table 1 provides details on 10 different categories related to the biosecurity portion of the audit. In order to provide the greatest feedback to participants, recommendations were part of the Audit Report Card that farms have received for participating in the project. The biosecurity portion of the audit process utilized an “On-Farm Biosecurity Evaluation Tool” developed by the Centre de développement du porc du Québec (CDPQ) and was completed by the farm manager. If you would like a copy of this tool, see the Further Reading section below.

### Conclusion

Information presented within this article is based on the results of auditing 24 farms across Canada varying in location, size and type of operation. Overall, pork producers are doing a good job of staying on top of those management issues that could potentially be “profit-robbers.” It is important to remember to review policies and procedures in order to ensure that some seemingly small things do not get lost in the day-to-day activities within the production facility.

### For Further Reading

On-farm biosecurity evaluation tool (Français) <http://vsp.quebec/docs/>

BiosecuriteFermeAuditQ-FR.pdf (English) Document available upon request, contact M Christian Klopenstein, Ph. D., DVM ([cklopenstein@cdpq.ca](mailto:cklopenstein@cdpq.ca))



**Table 1. Biosecurity Assessment**

<b>How many sources do pigs entering the herd come from.</b> It is recommended that pigs come from one source only.	96 %	4 %	0 %	0 %
<b>Loading dock on each building is up to code.</b> It is recommended that a loading dock be heated, covered and with restricted access.	42 %	38 %	17 %	4 %
<b>Access to the building is limited to designated personnel &amp; authorized visitors.</b> It is recommended that visitors must always log in, doors should always be locked and proper signage should be in place (ex.: Keep Out – Biosecurity).	79 %	8 %	13 %	0 %
<b>A visitor registry is available and up to date (name, date, time of arrival and departure, last contact with pigs).</b> It is recommended that a visitor registry be kept and updated.	54 %	0 %	46 %	0 %
<b>Biosecurity procedures in place (shower, clothing, hand wash station).</b> It is recommended to shower, change clothes and boots before entering a barn.	83 %	17 %	0 %	0 %
<b>Protocols for entering or exiting the building are posted and respected.</b> It is recommended that protocols be posted upon entry of a barn.	67 %	21 %	13 %	0 %
<b>Staff properly trained regarding biosecurity protocols.</b> It is recommended that staff be properly trained regarding biosecurity.	100 %	0 %	0 %	0 %
<b>Biosecurity protocols are reviewed annually with staff.</b> It is recommended that biosecurity protocols be reviewed annually.	92 %	0 %	8 %	0 %
<b>All animal carcasses are placed in an area that is not accessible to scavengers.</b> It is recommended to place animal carcasses in an area that is not accessible to scavengers.	92 %	0 %	8 %	0 %
<b>The site layout allows for the recovery of animal carcasses (dead livestock) outside of the restricted access zone through a different access road than the one being used by the staff.</b> It is recommended to use a different road for the recovery of animal carcasses than the one used by staff.	38 %	21 %	0 %	42 %

Legend Meets recommendation Partially meets recommendation Does not meet recommendation Not applicable

*(Finding New Technologies... cont'd from page 1)*

the person entering the property and a record of who entered and exited the farm. Testing of the technology started in 2016, primarily in poultry in Ontario. Issues include 'drifting' of fence and applications not running on all phones (devices), but these are solvable. The platform has the advantage of being able to link with other subscribers and create a 'network' for communicating changing health status in a geographic area through daily health monitoring inputs from the production supervisor. With the veterinarian linked in, there could be early warning of changing health status in participating farms. Long-term applications include potential for linking traffic between farm-sites in case of a foreign animal disease outbreak. This first technology brings up the issues of privacy and ownership of data and therefore may have its greatest benefit within a company of related barns. At an estimated \$300 per year subscription this a low-cost addition to the biosecurity program.

The transport truck is the link between barns and markets and is also the most significant vector of disease after the live pig itself. The next technology is from the food and hospital

industries, the ATP meter allows an instantaneous test of 'cleanliness' of trailers. A research project determined the likely areas that are not well-cleaned and the ATP meter swabs can be brushed on the metal and inserted into the reader for an instantaneous readout – clean, "please back up to the barn", or dirty "please go back and rewash before approaching my barn". At \$2,000 per handheld unit (reusable for years) and \$15-20 per trailer in disposable swabs this is unlikely to be used for finisher hog shipments but would make sense for the nucleus barn.

DrySist is a trademarked cleaning/baking process from Castene Trailer manufacturing in Spain. The process uses a site dedicated to completing the disinfection of washed trailers. When arriving at the site 'washed' the undercarriage is sprayed (automatically) with disinfectant. Backing into the baking station, a sliding wall moves up each side of the trailer enclosing it and forms a pinchpoint behind the cab. This concentrates the heat that is supplied by a heat generator moved into place and directed into the rear of the trailer compartment. The trailer can be previously outfitted with heat sensors that connect wirelessly to a central computer. Hot

air is blasted in the back until all sensors reach 72oC. The advantage is that it would use about 40% less gas than the current method of heating a whole building. Also, it does not heat the tires and running gear, instead heats the trailer from the inside out. The beta site is operational in Spain now.

Lastly for trailers - tracking trailers as part of total traceability is now possible while also capturing environmental data from various compartments in the trailer in real time. The Raspberry PI microcomputer (from UK) is the size of a credit card and can have numerous sensors attached to it (humidity, temperature, cameras, etc). This information can go directly to the operator's tablet in the cab ensuring driver oversight of the welfare of the animals in transit. A GPS chip adapter allows the trailer to be tracked. A commercial application (Trailer Genie) is under development. I noted that this basic microcomputer is currently on Amazon for \$55 Cdn each.

The next 'outside the barn' application is Hydrothermal Liquefaction (HTL) of biowaste. This University of Illinois project has identified *(Finding New Technologies... cont'd on page 9)*

# High Fiber Diets for Swine



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## Introduction

Feed cost represents more than 60% of the variable cost of swine production and a major part of the feed cost is to ensure that pigs have adequate energy and protein supply to reach their optimum potential in terms of the production goals. Corn, wheat, barley, and soybean meal have been the most widely used feedstuffs to meet the energy and protein requirements of pigs. However, the prices are variable over time. Therefore, swine producers have to look for feed resources to ensure economic sustainability of their business. Currently, canola meal and cereal grain co-products from the biofuel and milling industry are commonly used for diets in Western Canada because of their availability, low-cost and nutrient content. However, these alternative feed resources are typically fibrous in nature and when fibrous ingredients are incorporated into pig diets; the carbohydrate composition inevitably changes from a high starch diet toward a diet containing less starch and more non-starch polysaccharides, which are the major component of dietary fiber. Starch and dietary fiber, however, differ in several aspects apart from their chemical structures. For instance, starch is mostly digested and absorbed in the small intestine, fiber is not digested in the small intestine of pigs because monogastric do not produce the digestive enzymes that break down fiber. However, some fiber types can be fermented by the microbes in the pig's intestinal tract. Further, dietary fiber has the potential to reduce energy and nutrient digestibility and consequently depress pig growth performance. However, the reports have been rather contradictory and the

negative effects of fiber-rich diets on nutrient utilization and pig growth are influenced by the fiber source, type, and inclusion level. On the other hand, dietary fiber has received a lot of attention in swine nutrition in recent years because some fiber components have beneficial effects on pig gut health when fermented in the intestine, and can positively affect gestating sow welfare

pigs may reduce growth rate and feed intake even if such diets are balanced for NE and SID AA (Jha et al., 2013). Nonetheless, high fiber diets depress pig growth rate and feed intake in the nursery and growing phases more than in the finishing phase (review by Agyekum and Nyachoti, 2017). This is because older pigs have a more developed and bigger gastrointestinal tract and can, therefore, increase their daily feed intake to get the energy

“Replacing conventional feedstuffs with fibrous co-products reduces the DE content of the diet.”

## Fiber on pig performance

Replacing conventional feedstuffs with fibrous co-products reduces the DE content of the diet. This can lead to a reduction in the pig's ability to gain body weight with increasing dietary fiber level. For example, increasing the dietary levels of distillers dried grains with solubles (DDGS) up to 20% in nursery diets and up to 30% in grower diets linearly decreased pig body weight (Avelar et al., 2010; Agyekum et al., 2014). However, in some studies, diets containing high fiber co-products had no adverse effect on pig growth performance. The reduction in growth performance reported in some studies can be due to using inaccurate nutrient loading values and/ or not formulating diets containing a substantial amount of fibrous co-products using NE and digestible nutrients values (Wu et al., 2016). Therefore, swine diets containing fibrous co-products should be formulated based on NE, SID AA, and available P to ensure an accurate estimate of the amount of energy and nutrients that will be available for use pigs (Zijlstra and Beltranena, 2013). However, increasing the level of co-products up to 50% in diets for grow-finish

and nutrients required for their maintenance and growth. Additionally, adult pigs have a greater ability to ferment fiber than younger pigs. However, in weaned pigs, high-fiber diets reduce voluntary feed intake due to limited gut capacity, which reduces DE intake and thus growth rate.

Increasing dietary levels of fibrous co-products have been consistently shown to decrease dressing percentage especially when these co-products are included at 30% or more of the diet. This is because pigs have to increase their feed intake in order to compensate for the low energy value of high fiber diets, which results in adaptive changes in the gastrointestinal tract to accommodate high fiber diets. Therefore, the visceral organs increase in size and weight, which leads to an increase in energy and nutrients for maintenance and thereby decrease energy and nutrient retained for protein deposition. Therefore, no more than 30% of fibrous co-products should be included in finishing diets. Including some amount of fiber in grow-finish diets may also be useful in reducing back fat thickness, if pigs are fed low-crude protein, amino acid supplemented diets.

## Fiber on fermentation and intestinal health

Although pigs cannot digest dietary fiber, the microbes in their gastrointestinal tract can ferment some fiber types to produce an array of metabolites that can influence nutrient metabolism and promote intestinal development and gut health in pigs. The level and type of fiber along with their physiological properties like solubility and fermentability affect fiber fermentation in the pig's gut. In this context, fibrous ingredients (e.g. sugar beet pulp, resistant starch, and fructo- oligosaccharides) that are soluble and highly fermentable have been reported to produce greater fermentation products than insoluble fiber ingredients (e.g. wheat bran and DDGS). Soluble and fermentable fibers are fermented in the proximal end of the hindgut, whereas insoluble fibers are fermented gradually and the fermentation can be sustained until the end of the colon. Further, information in the literature suggests that high levels of insoluble fiber in pig diets may hamper or lead to lower microbial fermentation in the hindgut. Nonetheless, fiber fermentation in sows is greater than in growing pigs because sows have a well-developed gut capacity, high microbial activity, while digesta retention time in the sow's gut is longer for fermentation to occur.

Fiber fermentation products include volatile fatty acids (VFA; mainly acetic, propionic and butyric acids), CO<sub>2</sub>, H<sub>2</sub>, and methane gases. The VFA has been widely reported to be beneficial to intestinal development and gut health in pigs. For example, butyrate is used as an energy source by the colon cells to grow. Propionate and a certain amount of butyrate are used to produce glucose through the process of gluconeogenesis, whereas nearly two-thirds of acetate is metabolized in the muscle cells as fat (Slavin, 2013). Including soluble-fermentable fibrous ingredients like resistant starch and fructooligosaccharides in pig diets can stimulate the growth of beneficial bacteria (e.g. Bifidobacteria and Lactobacilli) and increase VFA production thereby lowering gut pH. The low gut pH has been reported to have a negative effect on the growth of pathogenic bacteria such as *E. coli* and *Clostridium perfringens* (Jha and Berrocoso, 2015), which cause enteric infections in pigs. Wheat bran and oat hulls, which are rich sources of insoluble fiber have also been reported to reduce the growth of pathogenic bacteria and the severity of intestinal infections in weaning pigs (Kim et al., 2008; Molist et al., 2011). For example, the addition of 4% wheat bran to a weaner diet, based on corn, wheat, barley, and soybean meal, reduced *E. coli* population and the incidences of diarrhea in



weaned pigs experimentally infected with *E. coli* K88+ (Molist et al., 2010). However, combining soluble and insoluble fiber in pig diets produces a superior response on intestinal development and health (Pieper et al., 2008; Molist et al., 2009). Therefore, fibrous feed ingredients can be incorporated into nursery and grower pig diets, as a strategy to reduce the incidences of enteric infections and thereby promote gut health. Currently, however, there are no recommended dietary levels of fiber for pigs to confer health benefits because this is difficult to establish and depends on the feed ingredients used for diet formulation. Additionally, it should be noted that a high dietary fiber inclusion rate can hamper nutrient utilization and pig growth performance.

## Fiber in gestation diets

Restricting the feed allowance of gestating sows is commonly practiced to prevent excessive body weight gain and the associated negative consequences on locomotion and reproductive functions. Sows still receive sufficient nutrients to meet their maintenance and reproductive needs; however, their daily feed allowance is not enough for the sows to achieve satiety. The lack of satiety due to restricted feeding has been reported to result in aggression and stereotypies (Lawrence et al., 1993), which are of great welfare and production concern in individual or group-housed gestating sows. Incorporating fibrous ingredients into pregnant sows diets have been reported to reduce hunger sensation and to reduce the aggression and behavioral problems associated with restricted feeding (de Leeuw et al., 2008). The beneficial effects of feeding high-fiber diets to gestating sows have been ascribed to their ability to delay gastric emptying and increase swelling of the stomach content and fermentation products (Jorgensen et al., 2010). Further, based on data from 24 studies published between 1975 to 2007, it was observed that sows that were fed high fiber

diets during gestation had improved lactation feed intake and weaned more pigs/litter on average than sows fed low fiber diets (Reese et al., 2008). Fibrous ingredients that are soluble and highly fermentable should be used because they have greater effects on satiety and sow lactation performance than insoluble fibrous ingredients. The Nutrition Group at the Prairie Swine Centre are currently running series of experiments utilizing hydrothermal treatment as a processing technique to improve the solubility of straws for group-housed gestating sows. The overriding objective is to evaluate the effect of processed or unprocessed straws on indicators of satiety and lactation performance of sows.

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# Assessing Trailer Cleanliness



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Proper wash and disinfection of swine transport trailers is an important step in maintaining biosecurity. Research projects have shown visual inspection of trailers is not a reliable assessment<sup>1</sup>. While traditional microbiological culture method can be used, they involve the use of plated media which need to be incubated and analyzed to obtain the level of contamination on the sampled surfaces. This approach can cause significant down-time for trailer operations and delays implementation of corrective actions while waiting for test results.

A rapid, easy to use and reliable way of monitoring surface cleanliness of swine transport trailers is needed for practical industry applications. ATP bioluminescence has been demonstrated to be a good alternative tool for monitoring surface cleanliness in swine transport trailers, providing results within minutes as opposed to days for traditional microbiological testing<sup>1</sup>.

In order to increase the speed of adoption of promising new technologies two demonstration sites were established (Quebec, Saskatchewan)

to test the reliability and feasibility of ATP Bioluminescence in assessing trailer cleanliness.

The project was implemented in two different wash facilities where a minimum of 10 trailers were sampled on a weekly basis (over a 23 or 30 week period), representing 53% and 18% of the total number of trailers washed respectively, in Quebec and Saskatchewan. Both demonstration sites followed a similar protocol of cleaning, washing, disinfecting and drying, where drying included heated bays in the winter and trailers



Swine Innovation Porc

**Table 1. Advantages and disadvantages of using ATP Bioluminescence**

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Easy to implement</li> <li>• Easy to train staff regarding use of the equipment</li> <li>• Employees more engaged in the cleaning process. Curious to know how well they were doing.</li> <li>• Removing some of the subjectivity from the cleaning process. Creates an objective measurement.</li> <li>• Rapid assessment of trailer cleanliness - no significant down time for trailer.</li> <li>• Trailers that required additional cleaning were identified prior to leaving the wash area.</li> <li>• Meter is multi-purpose – could be used to assess cleanliness in other areas of the operation.</li> <li>• Builds due diligence and a quality control component in the washing procedure</li> <li>• Fewer rejected trailers – arrival at production facilities.</li> </ul>	<ul style="list-style-type: none"> <li>• One more step in the cleaning process/ procedure. Sometimes gets lost in the daily routine.</li> <li>• Swabs need to be stored and handled correctly in order to ensure accuracy of meter reading results.</li> <li>• Swabbing could require entering the trailer after disinfection.</li> <li>• Samples a small area, doesn't eliminate a visual inspection.</li> <li>• Variance in meter readings related to potential environmental contamination – readings were higher if measurements were taken outside the wash/dry bay.</li> </ul>

being placed outside during summer months (April-October). In addition, a minimum of two swabs were taken for each trailer ensuring an accurate representation of trailer cleanliness.

**What Did We Find?**

As with any new technology proper implementation and training is key to ensure proper validation of the technology. In reviewing the results of both demonstration sites there are specific outcomes that can be categorized into advantages and disadvantages when using ATP Bioluminescence.

**Continued Use of ATP Bioluminescence?**

The jury is still out on continued use of ATP Bioluminescence. One demonstration site has made the decision to stop using ATP Bioluminescence in the clean, wash, dry and disinfect (CWDD) procedure largely based on variances experienced in the meter readings related to (potential) environmental contamination. Specifically it was difficult to establish whether the variation seen in meter readings related to an error in the CWDD procedure or to an external factor. This site will continue using third party visual inspection in combination with an annual training program with their employees to ensure quality control standards are met in the CWDD procedure.

The second demonstration site will continue to use ATP Bioluminescence perhaps even expanding its use within its internal truck wash facility. Both demonstration sites identified variances in meter readings related to (potential) environmental contamination, specifically when trailers were dried outside during summer months. They thought this could be addressed by adjusting the timing and increasing awareness related to sampling period and technique. They also felt it was an important step in the quality control

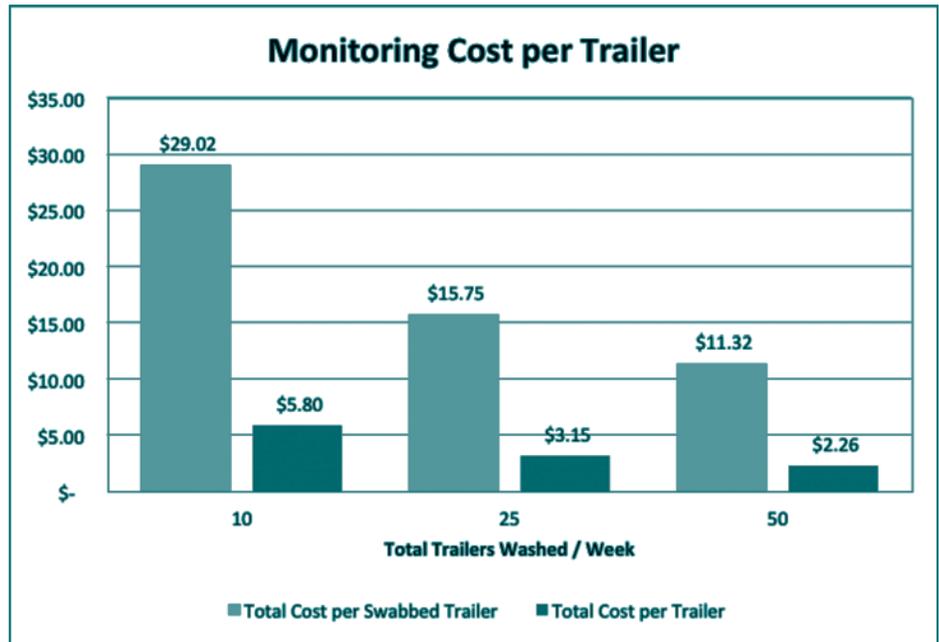


Figure 1. Economic analysis of incorporating ATP Bioluminescence in the trailer washing procedure. \*\* Calculations are based on 20% of total washes are swabbed using ATP Bioluminescence

process by removing some of the subjectivity in the CWDD procedure, in addition to creating more engaged employees. This site will continue to use ATP Bioluminescence combined with visual inspection as a method of maintaining quality control in the cleaning process.

**Economics**

The economics of using ATP Bioluminescence will be specific to each situation based on the total number of trailers swabbed as a percentage of total trailers washed. The following calculation is for illustration purposes only and may not reflect the two locations participating in the demonstration project.

Figure 1 outlines the potential range in costs associated with ATP Bioluminescence. The use

of ATP Bioluminescence may benefit all trailers in the fleet regardless if they were swabbed or not, as swabbed trailers should provide a reliable benchmark of balance of the fleet. This analysis used in Figure 1 also assumes the ATP meter is paid for in 1 year, extending the payback period for the ATP meter would reduce overall cost per trailer sampled.

**Conclusion**

Research indicated ATP bioluminescence method can be used as a supplementary tool for monitoring surface cleanliness of transport trailers in a rapid, simple, inexpensive and reliable way, to complement the CWDD procedures. However use of ATP Bioluminescence at demonstration sites indicates there are several distinct advantages and disadvantages to commercial implementation. Each company or individual looking to include ATP Bioluminescence in their CWDD procedure will need to accurately assess: Why are we implementing this technology? Where will it be implemented? Are we committed to it? What is the expected outcome and what will we do with it?

**For Further Reading**

1 ATP bioluminescence effective cleanliness assessment tool (English) <http://www.prairieswine.com/atp-bioluminescence-effective-cleanliness-assessment-tool/>



Table 2: Economics of ATP Bioluminescence Usage

ATP Bioluminescence meter	\$2,300	
ATP testing swabs (100 swabs / box)	\$345	
	Week	Year
Total number of trailers washed	25	1,300
Total Number of trailers tested (20%)	5	260
Total Number of swabs (2 per trailer tested)	10	520
Total swab cost	\$34.50	\$1,794
Total cost per swabbed trailer (\$4,094 / 260 trailers)		\$15.75
Total cost per trailer (\$4,094 / 1,300 trailers)		\$3.15

# The Next 25 – Looking to the Future with Prairie Swine Centre

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the Canadian Hog Journal,  
Winter 2018.

Written by Sheri Monk

The year 2017 was a big one for the Prairie Swine Centre (PSC), with commemorating 25 years as an organization high on the list of priorities. But as it turns out, it was also a year of transition and new beginnings. During the Saskatchewan Pork Industry Symposium in November, it was announced that long-time president and CEO Lee Whittington would be retiring in 2018, after 25 years of dedicated service.

So, what does the next 25 years have in store for the Prairie Swine Centre? Change, challenge and success.

"I've built a growth philosophy around author Steven Covey's Seven Habits of Highly Effective People," said Whittington.

His version, Seven Habits of Highly Effective Research Organizations, has been refined throughout his time and experience with PSC – some may even call it his legacy.

## **Number One: Issues, not disciplines, will engage your client**

Lee says stakeholders may not necessarily have a passion for engineering, and that means researchers need to look at disciplines such as engineering as a tool that facilitates dialogue, rather than an entity that defines the narrative.

"There are all kinds of disciplines that may affect an issue, but as an institution and as a smart researcher, you're going to focus on the issue itself because that's what's going to engage the industry to say, 'Yes, I want to invest in this person, because they understand the problem.' If the researcher doesn't get it intuitively, it's the role of the institution to build that relationship."

## **Number two: An industry-driven mandate keeps research connected to the customer**

In other words, figuring out what pigs dream about during REM sleep might be fun to investigate, but the resulting discoveries need to be relevant to the pork industry to be practical.

"The future of research centers, I think, is going to look a lot different than it looks now. I think every funding agency, whether it's a government or private institution, are all looking for results that are applicable. Maybe not in six months, or six years, but that they're applicable," said Whittington.

## **Number four: Be a catalyst – share facilities and collaborate**

There is strength in numbers, and wisdom in working together. It puts the needs of the entire sector ahead of individuals, and it builds opportunities that may never have existed before.

## **Number five: Develop people who will make a difference**

Whittington says the right people want to work at the right place for the right reasons. They're invested in the industry, and they're capable of putting a human face on the big (and pig) picture.



## **Number three: Professional management frees researchers to do what they do best**

"I think researchers should be allowed to research, and explore ideas, and do statistics, and so we really need to support them with accounting people, and tech-transfer people, so that they don't have to do some of those essentially mundane activities that are a bad waste of time. We need to surround them with professional management," he said.

"You need to recruit the kind of scientists who are really interested in seeing their ideas flourish. They like interacting with the public and they like talking about their work – they're not just interested in seeing something published in a journal," Whittington said.



**Number six: Global vision plus a BHAG (big hairy audacious goal, as popularized by author Jerry Porras)**

What might seem a fantastical idea at first can grow into an inspirational institution like Prairie Swine Centre has over the years. But that takes courage, vision and patience to stay the course.

**Number seven: Quantify the benefits to your stakeholders**

Whether it's their return on investment, the internal rate of return, or \$/pig marketed, stakeholders must be kept apprised of the bottom line.

Prairie Swine Centre is unique in how it's funded, and how it operates, and like all research programs that involve animal husbandry, they have to be in it for the long-haul.

"Research farms are expensive to run, relative to anything else that is run at a university. A research farm feeds animals every day and must continue to be able to, even when a grant runs out," Whittington said. "And I guess I made it my mission some years ago to try and make sure that that resource would be available into the future, because if we ever let it go or wound it down, I doubt that there's enough political appetite to restart such an expensive venture."

A tremendous advantage the Prairie Swine Centre has is its ability to ramp up a research program. It already has the people, livestock and the infrastructure needed to mobilize quickly. And that rapid responsiveness can make all the difference when there are big issues in the industry such as PED.

"Part of the beauty of the way Prairie Swine Centre was set up, and it's so unique, is that we get base funding to hire people with the right skill set, to let them explore some of these ideas. They still need individual project funding to move ahead, but at least we're given the latitude to hire an engineer, and as things evolve from air quality

to barn design, we've already got that person in there. We don't have to shut down one program and then apply for money on the next topic of barn design," Whittington explained.

One of the biggest challenges facing any research facility with an engaged group of stakeholders is trying to predict what will become the most relevant issues in the future. Research takes time – a lot of time – and just applying for and receiving funding can take months and months.

"Trying to pitch an idea at a pork board meeting projecting 10 years into the future when people are looking at me asking what I'm going to do for them tomorrow is difficult. We have to always be looking 3-5 years into the future so that we're not dated, and to make sure we are on top of market trends," he said.

But there's so much more to it than just knowing the hard facts and how the markets are performing, and that's some of the most rewarding stuff.

"It's really about relationships, and communicating with producers to you truly know what they're up against. Then you take that information and you shape it into funding, and hopefully at the end of the process you're able to look those producers in the eye and give them something they can use, and something that makes their life better," Whittington said.

Whether it's a marriage or a research centre, communication is the cornerstone to success.

"We've got to ensure that our researchers understand, communicate, and have empathy with industry because without industry support, they're going nowhere. And that's something I believe we have done very well at Prairie Swine Centre. Our team genuinely cares, and they are invested in the success not just of one research project, but in the entire industry. And that will be the key to our success in the next 25 years."



*(Finding New Technologies... cont'd from page 3)*

swine manure as potentially the best source to feed algae which are harvested and put through the HTL process to extract oil. No longer just benchtop (1998), this project has attracted partners (Snapshot Energy) which have constructed small plants in South Carolina and Texas capable of 40-160 barrels a day oil production. This is not commercially viable at today's oil prices but estimates breakeven at \$80/barrel. If designing new barns should we be altering the proposed building complex site and making provision for capture of manure and taking advantage of also adding food waste into the mix?

While we are considering siting of new barns maybe it is possible to be closer to populations, labour, utilities, services, etc if we make our barns 'good neighbours'. Doing this requires managing exhaust air vented from the barn (and the gases and odours associated with this ventilation). A project between CDPQ and PSC demonstrated that gases can be stripped from exhaust air and the nutrients captured, and remaining air 'cleaned' before being exhausted beyond the building. The design confirmed in 2013 that ammonia, dust and odour can be reduced by 77%, 92%, 75% respectively with a commercial-scale bio-trickling air filtration system. At the 2016 EuroTier show there were two companies demonstrating biotrickling cubes for just such a use. Cost per pig was not determined.



**Inside the barn**

This is where a proliferation of new devices will be introduced. From low-cost sensors to Bluetooth and wifi enabled technologies, the collection of data will be more frequent, and more complete. Thus, we should be able to make real-time decisions when conditions we determine are not optimal can be corrected before feed intake, growth or health is impacted.

For the purposes of this paper I will limit discussion to three in-barn innovations, all from Europe and all to be available within the next 2 years.

The use of Big Data is beginning to be understood and used by PigChamp Pro Europa. This Spanish company offers recordkeeping

*(Finding New Technologies... cont'd on page 11)*

# Personal Protection & Training

## Auditing Best Management Practices



Ken Engele, BSA  
Prairie Swine  
Centre

*In 2017, on-farm best management practices were audited on a total of 24 farms throughout Canada as part of a national project titled From Innovation to Adoption: On-farm Demonstration of Swine Research. This article is part of an eight-part series reporting on these audits.*

Ensuring a safe work environment is the responsibility of every employer and one that the Canadian pork industry is committed to. Results in Table 1 indicate pork producers are committed to providing the safest workplace possible for their employees. Audit results indicate that dust masks, hearing protection and hydrogen sulphide (H<sub>2</sub>S) monitors are being used to varying degrees in production units across Canada.

While all farms that use H<sub>2</sub>S monitors use them for pit pulling, it is very important that they be used in other key day-to-day activities where H<sub>2</sub>S could arise. One of these situations would be power washing, as workers may be exposed to

H<sub>2</sub>S concentrations that exceed acceptable limits. Locations of peak H<sub>2</sub>S concentrations vary within the room. It is important that monitors be provided to all swine barn workers at these key times as H<sub>2</sub>S may be present in higher than anticipated concentrations.

While approximately 60% of participating farms offer H<sub>2</sub>S training, it is very important that recertification does not get lost in day-to-day activities. Training and standard operating procedures should be provided, at least every three years, so workers can learn how to deal

promote ease of loading pigs include pen-walking before loading, minimal prod use, using appropriate handling boards and ensuring that group sizes are manageable. Producers realize the importance that proper pig handling plays in their operations, as audit results indicate a majority of the farms offer pig training to their employees. A number of different training methods were utilized, ranging from in-house training sessions, in addition to pig handling videos developed by various pork councils and organisations throughout Canada.

“A total of 24 farms were audited making this project the first of its kind to measure best management practices across the Canadian pork industry”

with routine operation and emergency situations generating high H<sub>2</sub>S concentrations. Low cost training sources are available through Assiniboine Community College and Prairie Swine Centre, with Prairie Swine Centre offering an online version of H<sub>2</sub>S Awareness to keep employees aware of dangers associated with H<sub>2</sub>S.

Regarding pig handling, research has shown that proper animal handling reduces stress for pigs and people. Strategies that reduce stress and

### Conclusion

Information presented within this article is based on the results of auditing 24 farms across Canada varying in location, size and type of operation. Overall, pork producers are doing a good job of ensuring adequate safety policy and procedures are implemented on-farm. It is important to remember to review policies and procedures annually to ensure the safest work environment possible.

Table 1. Personal Protection and Training Audit Results

Category	Average Percentage of Farms		
<b>Are dust mask used in the facility?</b> It is recommended to use dust masks in the facility.	83 %	0 %	17 %
<b>Is hearing protection used in the facility?</b> It is recommended to use hearing protection in the barn.	100 %	0 %	0 %
<b>Are hydrogen sulphide monitors used in the facilities?</b> It is recommended to always use hydrogen sulphide monitors in the facility.	0 %	50 %	50 %
<b>Do you provide training on hydrogen sulphide awareness?</b> It is recommended to provide training regarding hydrogen sulphide awareness.	54 %	4 %	42 %
<b>Do you provide animal handling training?</b> It is recommended to provide animal handling training.	75 %	4 %	21 %

Legend

Meets recommendation

Partially meets recommendation

Does not meet recommendation

For Further Reading

Mask use in swine barns reduces health effects  
 (English) <http://www.prairieswine.com/mask-use-in-swine-barns-reduces-health-effects-2/>

Hydrogen sulphide concentration while pulling pit plugs and power-washing rooms  
 (English) <http://www.prairieswine.com/hydrogen-sulphide-concentration-while-pulling-pit-plugs-and-power-washing-rooms-2/>

Engineering controls to reduce hydrogen sulfide exposure of workers in swine buildings  
 (English) <http://www.prairieswine.com/engineering-controls-to-reduce-hydrogen-sulfide-exposure-of-workers-in-swine-buildings/>

TRAINING  
 Manitoba Pork  
 (English) <http://www.manitobapork.com/human-resources/training-opportunities>  
 Hydrogen Sulphide Awareness Training for Liquid Manure Handling Systems  
 (English) <http://www.prairieswine.com/training/>

PIG HANDLING  
 Proper Pig Handling  
 (English) <http://www.manitobapork.com/animal-care/pig-handling>  
 Video clips on certain practices during the last 24 hours prior to shipment to the slaughterhouse  
 (English/Francais) <http://www.cdpq.ca/recherche-et-developpement/projets-de-recherche/projet-221.aspx>



*(Finding New Technologies... cont'd from page 9)*  
 services which has lead them to begin mining the database for trends and the first Big Data output is a realization that most swine herds have 'Super Sows' and that these females can be identified as giving 15 liveborn in the first litter. Records on over a million matings identified that these females have a 6% higher farrowing rate and will produce 26 more live born pigs in her lifetime than their herd-mates. This detailed analysis lead to advanced management procedures that should be followed once the 'Super Sow' is identified. Long-term strategies include selecting for more of these prolific, long lasting females in the herd and use of predictive analytics. The current estimate is that these high-performance sows reduce the cost of production by \$6 USD per 20kg weaned pig produced.

This same group has taken the commercially-available digital pen and created software that allows a pen and paper solution in the barn (instead of expensive phones/PDA). A proprietary software application has been developed that allows the farm to determine the questions they

want to ask and measures they want to be taken in the barn. The special paper form created links to the digital pen and through Bluetooth and wifi links in real-time to the home office. A screen that appears in the office, converts handwritten numbers and letters into digital and allows for verification (sloppy writing) and saving of a digital file for later analysis. This has been used for example to score foot problems in the herd and categorizing individuals by 5 different problems and whether the problem is light, medium or severe. Whole herd shifts in hoof health can then easily be monitored and managed over time. Cost to be determined.

The Vetic was developed by Optimal Pork Production (OPP) in Spain and manufactured by Henke Sass in Germany. This will become available in 2018 and will provide complete traceability of injectables by linking the pig/pen/room through RFID tags by having a reader right on the syringe. This allows the quantity of product with detail of the day and even lot number of the product injected to be recorded and that record linked to that pig. Retail price has not been set

but with changes in antibiotic regulations and RWA programs, this type of technology will likely become part of the future infrastructure of traceability on farm.

**The Bottom Line**

The technologies identified here are proving to be robust, reliable and inexpensive. It is likely that an abundance of independent manufacturers from diverse industries will look at animal agriculture, and attempt to measure or monitor welfare, environmental pressures and food safety with their technologies. What will be needed is a method to evaluate systematically how well the products work, the data integrity and security and the link to decision support software and methodologies required to get value out of the technology. If this is done correctly there is value for the industry, otherwise we do not need 'High-Tech Hype' technology just for the sake of technology that isn't moving us in a strategic direction of making pork the prime choice of meat protein for consumers world-wide.



## U of S Researcher Awarded \$2 million to Study Swine Welfare



As a specialist in animal behaviour and welfare, Yolande Seddon is working with the swine industry coast to coast to develop robust and resilient pigs to improve their health and welfare. "This program will help place Canada at the forefront of progressive swine management that accommodates animal welfare, while supporting efficient and ethical food production and providing students a unique opportunity to broaden their scientific knowledge in pursuing careers in animal welfare," said Seddon, an assistant professor at the Western College of Veterinary Medicine (WCVM).

"This chair is an opportunity to contribute science to advance sustainable production systems that operate in a way consumers regard as acceptable," she said. "This work is important to sustainable and ethical food production that promotes global food security."

Seddon's research will contribute to the scientific understanding of methods to improve animal welfare and identify progressive management approaches. The results could

support changes to the industry's current codes of practice that establish the required and recommended practices of animal care.

Specific goals of the research program are to:

- Contribute to understanding early life influences on the growing pig in the development of sociability, resilience and welfare outcomes.
- Understand the role of play to enhance pig welfare and promote beneficial production characteristics.
- Identify and validate biological markers that can indicate pig welfare, including those that indicate longer-term welfare states and enable industry to monitor animal welfare on farms.
- Assess the value of welfare indicators observed from carcasses during abattoir meat inspection to yield accurate information about the welfare that pigs experience on farms.

NSERC provided \$837,750 for the program. With Canada's swine industry providing a matching \$837,750 along with in-kind support, and the U of S committing funding over the five-year term of the chair, Seddon's project totals almost \$2 million. The research and training program will involve up to 10 undergraduate students, five graduate students, and two post-doctoral fellows.

By exploring some of the most promising concepts under controlled research conditions, the researchers and producers will gain valuable experience in applying and testing these strategies on commercial farms so that productive findings can be incorporated into partner facilities.

For more information please visit [https://research.usask.ca/our-impact/highlights/discoverydigest/2018-march/u-of-s-researcher-awarded-2-million-to-study-swine-welfare---.php?utm\\_source=dd&utm\\_campaign=2018mar](https://research.usask.ca/our-impact/highlights/discoverydigest/2018-march/u-of-s-researcher-awarded-2-million-to-study-swine-welfare---.php?utm_source=dd&utm_campaign=2018mar)

### World Pork Expo

June 6-8, 2018  
Des Moines, IA.



### Alberta Pork Congress

June 13-14, 2018  
Red Deer, AB.

### Ontario Pork Congress

June 20-21, 2018  
Stratford, ON.

### Alberta Livestock Expo

October 10, 2018  
Lethbridge, AB.

### Red Deer Swine Technology Workshop

October 24, 2018  
Red Deer, AB.



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