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In This Edition

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A look forward a look back
Prairie Swine Centre at your service

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

CENTRED ON SWINE

The Newsletter of Prairie Swine Centre Inc.

Fall 1995

New Swine Nutrition Guide to be Launched at Pork Industry Symposium

John Patience
Co-author of Swine Nutrition Guide and President of PSC

Some highlights of the Swine Nutrition Guide, 2nd Edition:

- Expanded to 12 chapters.
- A chapter dedicated to water, the "forgotten" nutrient.
- Each chapter has been completely rewritten.
- A one-stop, easy-to-read reference.
- Now includes plenty of sample diet formulations.

In This Edition ...

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Dust Control in the Swine Barn ..... pgs. 4 & 5
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The first issue of Centred on Swine was published in Fall 1993 and contained articles on 'Preparing for Winter Ventilation'; 'Monitoring Performance in Growing-Finishing Pigs'; Feed Value of Damaged Wheat-A PSC Formula' ; 'Oil Improves Barn Air Quality'. Some topics in our industry have a timeless nature!

Much has changed in the industry however since that first publication but the focus on practical applications of new scientific knowledge is a hallmark of the Centre. Dr. John Patience lead and was part of the team that designed the Centre and for the first 15 years served as the President, setting the pace for and providing the face for the Centre at countless meetings across Canada and beyond. Any tribute to the people of the Centre needs to recognize the unique role John played blending science and Centre administration to shift the thinking of what research can do for industry. Others joined the Centre and contributed greatly to its developing brand and effect, but it took a bright bold vision to galvanize those people. John and the volunteer board of directors provided that.

"People do business with people"

I am sure our staff and Directors have heard me say that at least once at every meeting for the past two decades. Why, because its true and we must never forget that we are placed in positions of trust and accountability to 'serve others'. The more we understand the people we serve the more likely our service will be successful. Its really that simple, and a lesson that is drilled into those that choose to sell as a career. One of those early 'sales' books was titled "Living is Selling" by Jean-Marc Chaput (published in Canada in 1975) who so succinctly described "…selling is to live intensely…To sell is to communicate, to convince, to respect and to help others."

This is my last article in Centred on Swine as President/CEO of Prairie Swine Centre, I will be

(A Look Forward A Look Back... cont'd on page 3)

(A Look Forward A Look Back... cont'd from pg 1)

The Advisory Board consisted of from front left: Dr. David Fraser (ON), Dr. John Patience (SK), Dave Price (AB), Dr. Al Theede (SK), Vic Pouteaux (MB), Dennis Hodgkinson (MB), Garth Larsen (SK), Don Lidster (SK), Dr. Harold Fast (SK)

retiring June 30, 2018, and I want to save these pages to salute the people that have made a difference through their contributions to assist Prairie Swine Centre to 'sell' its message that - applied research can be a formidable tool in creating change in an industry.

26 years ago a new non-profit research business was established, new staff hired with a new business concept, and a unique relationship to the industry and university. Like many new ideas this one was born out of a matter of necessity, the old model wasn't working and the centre, as a farm within the Department of Animal and Poultry Science was to be closed.

But before we look further back - first a safety message. This is something I instituted over 10 years ago, start every meeting and presentation with a safety message. We are dependent on our people and they can only contribute if they are safe and healthy at work. All of our businesses depend on people. Are we doing everything we can to ensure it is a safe and productive workplace? As I write this article I am reminded that we have a responsibility to our most vulnerable employees – new employees, especially this time of year when summer students arrive. Barns are large, and complicated and perhaps in our day to day we have become complacent through familiarity. The Centre sits at 0.75 days/yr without a lost time injury over the past 4 years. Not bad, but the month of May is a focus on reminding us of the importance of 'safety first' in all we do. Last year we had 11 new students (summer and graduate) join us, only a couple had ever been in a pig barn before. It reminds us "they don't know what they don't know". Orientation of new employees is important and after biosecurity awareness training, and well before their research and pork production tasks are described there is safety awareness. Not just for the new employee but also reminders for the permanent employees who must now watch out for themselves as well as these new recruits. Make it a habit to start every meeting every month with a safety tip.

Over the years many dedicated producers, government, university and service industry professionals have donated their time and talents to guide the Centre and to them much credit must be given for having foreseen the trends, lobbied on the Centre's behalf and provided discipline of purpose in both good times and bad that has resulted in a recognizable world-wide brand in applied pork research. Certainly other institutions are larger and better funded, and have nurtured excellent 'super stars' that produce game changing ideas and through this work become well known in the academic environment and within the commercial industry. But none in my opinion have produced a brand that is known and that represents a multi-disciplinary approach to solving commercial problems like Prairie Swine Centre has.

There have been over 50 graduate students that have been trained at the Centre, and they have been mentored by innovative research scientists and assisted by technicians and production personnel to complete projects and talk about the results in Centred on Swine as well as many other publications. It is impossible to name and have a photo of all those who have contributed, the staff photo below serves to recognize all those dedicated people who created the knowledge. One of our recent graduates, Dr. Laura Eastwood represents the kind of contribution these people make. Starting in a Masters in Nutrition program, Laura transitioned into a PhD and upon graduation and recently moved to Ontario to work as a swine specialist for the Ministry of Agriculture. I caught up with her last June at the Pork Congress and heard all about a project she had launched to take some new ideas on piglet feeding, pair that with a supportive industry partner (Masterfeeds) and after significant on-farm trials the company

launched a new product to help piglets transition to solid feed. This is exactly the type of innovation that the Centre was envisioned to do.

The largest group to honour is our pork producer supporters across Canada that through their check-off contributions have provided base funding for the Centre.

People will continue to drive innovations and through their personal relationships and dedication they will continue to "find a way" to address new challenges as they appear.

7 Habits of Highly Effective Research Organizations

1. Issues not Disciplines will engage your client
2. Industry driven mandate, and stay connected to the customer
3. Professional management; free researcher from administration
4. Be a catalyst - share facilities and collaborate
5. Develop people who will make a difference
6. Global vision, plus a BHAG
7. Quantify benefits - ROI, IRR. $ per pig marketed

Washing procedures

Auditing Best Management Practices - Part 3

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.

Animal drinking and cleaning are the top uses of water in swine barns. Using water conservation strategies to reduce water use will ultimately lower cost of production and contribute towards a more sustainable environment as less manure is produced.[1] Re-assessing your washing protocol may provide an opportunity to effectively improve your bottom line.

Results from the audits indicate a majority of producers pre-soak rooms prior to washing. However, research indicates that there are situations in which this may not be necessary, as water sprinkling (or soaking) results in significantly higher water consumption. Specifically, research reinforces that high pressure washing in fully slatted flooring can be done without prior water sprinkling (soaking).

On the other hand, significantly more time was needed when washing partially-slatted concrete flooring without sprinkling. Therefore, it is important to remember that soaking is still beneficial if your farm has partially slatted floors throughout grower-finisher areas. Information presented in Figure 1 shows that approximately 80% of the farms audited pre-soak rooms. However, this figure does not differentiate between flooring (partially or fully-slatted) types.

Nozzle Selection

Figure 2 shows slightly more than 50% of participating producers currently use conventional nozzles in the washing process. Research reinforces that this is the best choice when it comes to water conservation. Use of conventional nozzles led to the lowest water volume consumed and time spent in washing rooms with partially and fully slatted concrete flooring among all tested nozzles.

Conclusion

Research has shown that barn evaluation of selected water conservation measures indicated high pressure washing in fully slatted flooring can be done without prior water sprinkling (soaking). In addition the use of conventional nozzle for pressure washing led to reduced time and water consumption during cleaning.

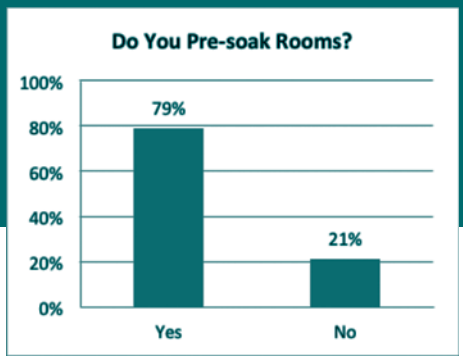


Figure 1. Percentage of audited farms that pre-soak rooms prior to the washing process

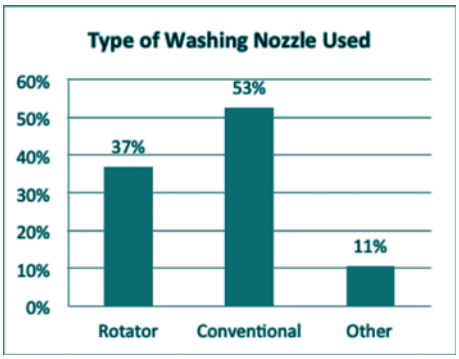


Figure 2. Percentage of each type of pressure washer nozzle used in the washing process on the 24 audited farms.

For Further Reading

1 Developing Strategies for Water Conservation for Producers (English) http://www.prairieswine.com/developing-strategies-for-water-conservation-for-producers/

My parting thoughts are all about how people at PSC will continue to attract innovative people, dedicated to moving new scientific knowledge onto the farm. For those people at PSC, their research collaborators world-wide and their supporting industry network I leave some thoughts on how I have seen success develop for this Centre and other research centres around the world. I have meshed these observations with Steven Covey's world-wide best seller – the 7 Habits of Highly Effective People. Yes, its all about the people and the innovative ways they seek to work with others that is the real engine of change over time.

Best wishes to all my friends in the Canadian pork industry and thank you for the unique opportunity that I was provided to contribute.

Performance response of piglets to acid-preserved, high-moisture wheat as alternative to in-feed acidification

by Elizabeth Shih (Elizabeth Shih Communications)
Research by Danilo Sotto[1], Jr and Denise Beaulieu (University of Saskatchewan)

Background

Pigs do not secrete sufficient amounts of hydrochloric acid (HCl) in their stomachs at the time of weaning to effectively digest protein and maintain gut health. Previous decades of research have established that adding acid to the feed of weanling pigs will lower pigs' gastric pH and so increase their digestive efficiency and health. For instance, pigs' stomach acid provides a barrier to pathogenic microorganisms, since low pH conditions control those populations. And acid can also improve the digestion of protein, and other nutrients. Typically, when weanling pig diets are supplemented with dietary acids to enhance digestion, piglet growth rates increase by 6 to 12% (Tung and Pettigrew, 2006).

Wheat, one of the main cereals used on the Canadian Prairies as an energy source in pig feed, is typically harvested at < 15% moisture to maintain its quality during storage. However, when environmental challenges to farming result in high moisture, low quality wheat crops, producers often resort to drying grain artificially or storage in oxygen limiting silos. But these processes can jeopardize nutrient value and increase producers' costs for fuel, power and specialized drying structures. As an alternative, high moisture, low quality wheat can be preserved by acidification for use as piglet feed, which simultaneously can improve weanling digestive growth and health.

Whether the benefits of diet acidification are maintained when piglets are fed acid-preserved high-moisture wheat is not known and requires further investigation. Therefore a nursery feeding trial was conducted to evaluate the efficacy of feeding acid-preserved, high moisture wheat as an alternative to in-feed acidification.

Experiment Method

Wheat was reconstituted to 20% moisture content and then either a commercial, phosphoric acid-based feed acidifier or propionic acid was added. The mixture was then stored in polyethylene barrels for 34 days. Carbon steel and galvanized steel coupons were embedded in the treated grain to measure the effects of acids on corrosion rate in storage silos and bins.

As Table 1 indicates, galvanized steel was more prone to corrosion than carbon steel. Propionic acid was more corrosive than phosphoric acid.

Grains were additionally monitored for mould growth and, when found high, were analyzed for a complete mycotoxin profile. (See Table 2.) Throughout the trial, the amount of mycotoxin in the wheat fell below the maximum allowable level.

A total of 160 newly weaned pigs (21 days of age, approx. 6.5 kg in body weight) were weighed and randomly distributed to 40 pens with 4 pigs per pen. Pens were assigned to 1 of 5 treatments in a randomized complete bock design. Treatments were arranged to measure the effect of each type of acid (phosphoric vs propionic) and the two methods of application (acid-preservation of moist wheat vs direct acidification of dry wheat), plus a non-acid control.

To summarize: piglets were fed with a wheat based diet without acid (the control), an acid-preserved wheat with phosphoric acid (APW-Phos), an acid-preserved wheat with propionic acid (APW-Prop), an acidified diet with phosphoric acid (AD-Phos), or an acidified diet with propionic acid (AD-Prop).

A phase 1 diet was provided between days 0 to 7 and the phase 2 diet was given from days 8 to 21 post-weaning, followed by a common phase 3 diet from days 22 to 35.) The average daily gain (ADG) and average daily feed intake (ADFI) were collected at days 7, 21 and 35 and were used to calculate feed efficiency (G:F=ADG/ADFI).

Table 1: Corrosion rate of carbon steel and galvanized steel exposed to either phosphoric or propionic acid when used as preservatives for high moisture wheat

Acid	Coupon Type	Average corrosion rate, mils per year	Classification
Phosphoric	Carbon Steel	0.16	low
Phosphoric	Galvanized Steel	7.00	severe
Propionic	Carbon Steel	2.94	mod
Propionic	Galvanized Steel	7.46	severe

Table 2: pH and mould measurements in acidified, high moisture wheat

Acidified High Moisture Wheat			
Item	*Initial*	*Finl*	*Mould Count, colony forming unit/gram*
Phosphoric Acid (Phos)	*4.27*	*5.72*	*7,000*
Propionic Acid (Prop)	*4.56*	*4.85*	*20*

1. D. Sotto, Jr is the recipient of the Gowans Feed Consulting Award Program at the Prairie Swine Centre and a PhD Candidate in the College of Agriculture (University of Saskatchewan).
2. Denise Beaulieu (PhD) is an Adjunct Research Scientist at the Prairie Swine Centre and an Assistant Professor in the College of Agriculture (University of Saskatchewan).

Results

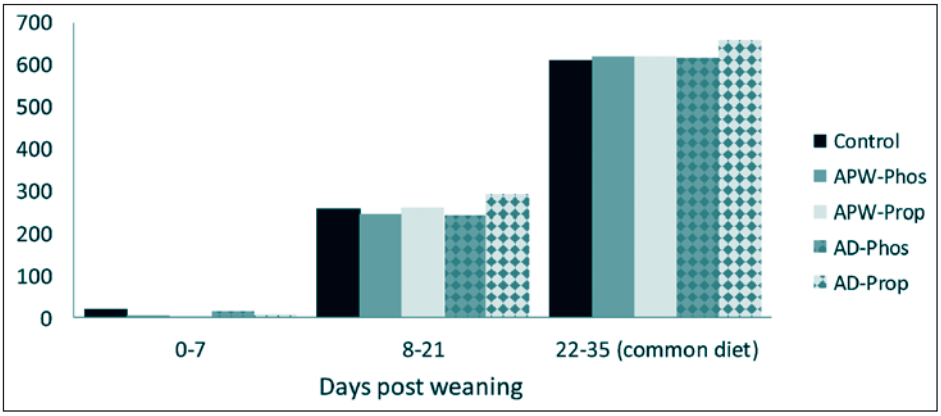
Grain quality, grain pH, mycotoxin levels, and corrosion rate. When the grain was in storage, the mould count of the phosphoric acid-preserved wheat (APW-Phos) was higher than the propionic acid-preserved wheat (APW-Prop). However, toxin analysis consistently found that the mycotoxin levels in phosphoric acid occurred at levels lower than the maximum allowable limits. The pH in phosphoric acid-preserved wheat (APW-Phos) increased from pH 4.27 to pH 5.72, while the pH in propionic acid-preserved wheat (APW-Prop) increased from pH 4.56 to pH 4.85. (Again, as Table 1 above indicates, galvanized steel was more prone to corrosion than carbon steel; and propionic acid was more corrosive than phosphoric acid.) Overall, the trend after the addition of acid to the wheat was for pH to rise over time, most notably for wheat preserved with phosphoric acid. The pH may rise due to issues such as the production of ammonia by microorganisms, the reaction of grain components to the acid and the evaporation of the acid, itself. The benefits of using wheat preserved by phosphoric acid (including enhanced gut health for piglets) may be gained without producers having to manage the corrosiveness of propionic acid.

Growth rate (ADG). Acidification, the type of acid and the method of acid application, or a combination of all three, had no effect on the growth rate of pigs during days 0 to 7 after weaning, and days 22 to 35 after weaning. However, during days 8 to 21 after weaning (phase 2), there was a tendency for pigs fed diets with propionic acid, regardless of the method of application, to grow at higher rates compared to those fed diets with phosphoric acid.

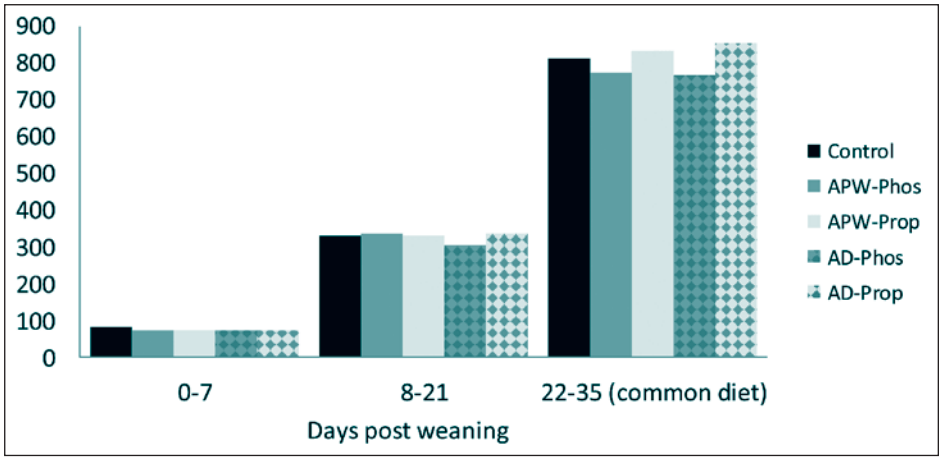
Feed intake (ADFI). Acidification, the type of acid and the method of acid application or a combination of all three had no effect on feed intake of pigs during days 0 to 7 after weaning, and days 8 to 21 after weaning. However, during days 22 to 35 (phase 3, when pigs were fed a common diet), pigs fed propionic acid during phases 1 and 2 had higher feed intake compared to those fed phosphoric acid, suggesting a potential for a carry-over effect (for propionic acid).

Feed efficiency (G:F). Acidification, type of acid and the method of acid application or a combination of all three had no effect on the feed efficiency of pigs during days 0 to 21, after weaning. During days 8 to 21 (phase 2), pigs fed propionic acid had improved feed efficiency compared to pigs fed the non-acid control ($P<0.05$); and compared to pigs fed diets with phosphoric acid ($P<0.01$). However, during days 22 to 35 (phase 3), pigs fed phosphoric acid during phases 1 and 2 had higher feed efficiency compared to those fed propionic acid, again suggesting a potential for a carry-over effect (for phosphoric acid).

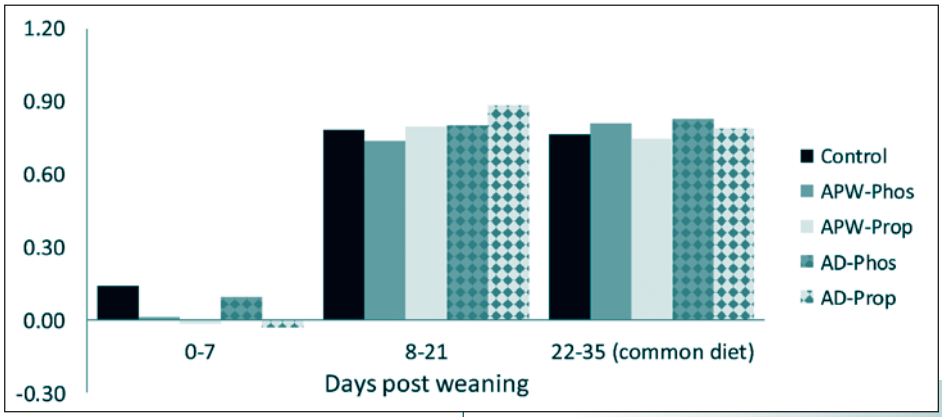
Graph 1: Average daily gain (ADG; grams/day)



Graph 2: Average daily feed intake (ADFI; grams/day):



Graph 3: Feed Efficiency (G:F; gram/gram/day):



The Bottomline

One objective of this trial was to determine the effectiveness of feeding acid-preserved, high moisture wheat as an alternative to directly supplementing acid to the wheat diet of weanling pigs. Acidification of wheat with propionic acid resulted in a significant improvement in feed

(Performance Response ... cont'd on page 7)

Demonstrating water conservation

Ken Engele, BSA
Prairie Swine Centre

Water is an essential nutrient in pig growth and sometimes can be an easily overlooked part of pig production. Research has found that finisher pigs waste 25% of water from nipple drinkers, even when they are properly adjusted (700 ml/min and positioned 5 cm higher than the shoulder height of the smallest pig)[1]. However, on commercial farms, water wastage from nipple drinkers is reported as high as 40 to 60%. The difference between these results may partly be attributed to the improper drinker height and flow rate on farms. Recent audits of 24 farms across Canada indicate that approximately two-thirds of nipple drinkers (in finishing) provided water volumes that exceeded the pig's requirement. In some cases, measured values were more than double of the required flow rates.

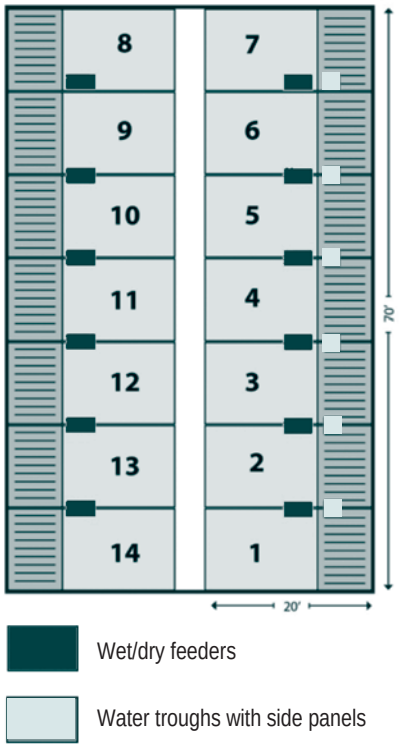


Figure 1. Room layout and setup for demonstration at the commercial farm.

Figure 2. Installation of the water trough with side panels at the commercial farm.

Water Conservation

Barn evaluations of selected water conservation measures indicated that, relative to conventional nipple drinkers, the use of a drinking trough with side panel (and constant water level) saved a significant (60%) amount of water mainly due to reduced water wastage, without adversely affecting pig performance[2]. With the promise associated with this innovation, based on the results of work conducted at Prairie Swine Centre[2], it was decided to implement the trough with the side panel setup on a commercial farm to understand if similar water savings can be achieved.

As seen in Figure 1, a single room was split into two distinct areas with pens 8 to 14 containing a wet/dry feeder and single nipple drinker per pen, which represents a typical room setup. Pens 1 to 7 also contained a wet/dry feeder however the water source was modified to include a trough with side panels integrated with the nipple drinker (Figure 2). In order to measure water disappearance, water meters were installed for each system within the room, and water disappearance rates were measured for two room turns (12 weeks/turn) between May and October 2017.

Economics

The following example provides an overview of potential savings for one specific site in Saskatchewan. Over the 24 weeks that the demonstration project was carried out, water disappearance in pens 1 to 7, where troughs with side panels were installed, was 20% lower when compared to the traditional nipple drinker setup.

Assuming that finishing pigs consume 7 litres of water on a daily basis, the difference in total water disappearance over one year would be 89,250 litres for 170 pigs (Table 1). Also, assuming a manure disposal rate of $0.0175/gal and that the (water disappearance) difference winds up in the manure pits, this would translate into a total additional manure disposal cost of $343 for 170 pigs or $57/pen.

Table 1. Economics of water disappearance

	Water System	
	Troughs with side panels	Nipple drinkers
# of Days	350	350
# of pigs	170	170
L/Pig	7	8.5
Total Water Disappearance (L)	416,500	505,750
Difference (L)		89,250

Table 2: Advantages and disadvantages in implementing troughs with side panels

Advantages	Disadvantages
• Significant water savings • Reduced manure volume • Installed with off-the-shelf components • Improved biosecurity – less traffic to the barn site. – Some sites require manure removal in spring and fall. If water wastage can be reduced farm-wide, manure removal may be reduced to a single application per year.	• One more thing to wash - corners • Higher potential contamination of water in the trough

For this specific site, the producer could expect a 2 to 3.5-year payback on an investment when implementing troughs with side panels in finishing barns.

It must be noted that potential water savings and costs are very farm-specific. For example, some farms may be part of a rural water utility and need to also include the cost of water in their analysis. Every producer should take the opportunity to assess potential savings related to manure disposal, water use, and pumping costs on a regular basis.

Potential Savings

Manure Disposal

- Manure application rate - $0.0175/gallon
- Additional manure volume – 89,250 L or 19,658 gallons
- Additional application cost - $343.57 for 170 pigs over 350 days.

Water Use

- Cost of water - $10.00 per 4,546 litres (1,000 gallons) or $0.0022 /litre
- Additional water cost – 89,250 L @ $0.0022/L = $196.33 for 170 pigs over 350 days.

Installation Costs

- Labour: 2 employees @ $20/hour @ 10 hours = $400 total labour cost to install a trough with side panels integrated with the nipple drinker in 7 pens.

Materials and Supplies

- Trough with side panel (custom fabricated, aluminum) - $100 /pen
- Additional hardware and fittings $10 /pen
- Total installation cost - $1,170 for 7 pens or $167 /pen

Implementation

As with any new technology, proper implementation and training is key to ensuring proper assessment of its use. One of the first questions often asked by staff is: "Will it make my life easier?" After all, this would be the ultimate goal of adopting any new technology. By reviewing the results of the demonstration site, several distinct advantages and disadvantages have become evident.

Conclusion

Based on the results generated from the demonstration project, the producer involved will continue to utilize the trough with the side panel setup within the facility. For this producer, the most interesting advantage was the significant water savings combined with the associated reduction in manure volume produced in the pens where the trough with side panels were installed.

Other Considerations

Research indicates that finishing pigs waste more water when the flow rate is higher[1]. Audit results also show approximately two-thirds of finishing nipple drinkers provide flow rates higher than required by pigs[3]. Producers are well aware of the advantages associated with fine-tuning their water management, however they sometimes lack the resources – time – to ensure it is being carried out on a timely basis. Perhaps incorporating this innovation on the farm can act as an insurance policy when it comes to water management and reducing water wastage.

We would like to acknowledge the support of Fast Genetics (Spiritwood, Saskatchewan) for participating as a demonstration site in the project.

For Further Reading

1 Reducing Water Wastage from Nipple Drinkers by Grower-Finisher Pigs (English) http://www.prairieswine.com/reducing-water-wastage-from-nipple-drinkers-by-grower-finisher-pigs/

2 Developing Strategies for Water Conservation in Swine Production Operations (English) http://www.prairieswine.com/developing-strategies-for-water-conservation-in-swine-production-operations/

3 Managing Water Intake: Auditing Best Management Practices - Part 8 (English)

(Performance Response... cont'd from page 5)

efficiency (G:F) in pigs on days 8 to 21 after weaning, regardless of the method of application. This improvement occurred by contrast to the non-acid control and to diets containing phosphoric acid. So feeding acid-preserved wheat using propionic acid (APW-Prop) had comparable performance with pigs fed acidified diets using propionic acid (AD-Prop).

The addition of phosphoric acid to wheat did not significantly affect piglet performance, and its potential as a grain preservative requires further investigation.

Regardless of which acid is used, producers will find it useful to know that galvanized steel is more prone to corrosion than carbon steel. Furthermore, propionic acid is more corrosive than phosphoric acid in carbon steel (but not in galvanized steel). Overall, organic acids such as propionic acid are typically more expensive, and, as we found out in this study, are also more corrosive to farm equipment than the inorganic phosphoric acid.

A second objective of this trial has been met—that through acid preservation producers will have an alternative tool of using low quality, high moisture wheat as feed, with a potential to reduce cost by eliminating the need to dry the grain artificially.

Acknowledgments:

This project was financially supported by Swine Innovation Porc, as part of Growing Forward II. Denise Beaulieu and Danilo Sotto, Jr also gratefully acknowledge the strategic program funding provided by Sask Pork, Alberta Pork, Ontario Pork, the Manitoba Pork Council and the Saskatchewan Agriculture Development Fund. Finally, Denise Beaulieu and Danilo Sotto, Jr thank the production and research technicians at the Prairie Swine Centre Inc., who made it possible to conduct the experiments that support this trial.

Danilo Sotto, Jr also gratefully acknowledges the Gowans Feed Consulting Graduate Student Award Program that has provided him with an industry funded position to undertake graduate research and experimentation at the Prairie Swine Centre.

Editor's Note:

Danilo Sotto, Jr was recently awarded the R.O. Ball "Young Scientist Award" at the Banff Pork Symposium (January 9 to 11, 2018) for his research on weanling diets. From a pool of some 20 students, Danilo was named one of only four finalists, and then won the competition. Judging was based on the quality of applicants' research abstracts and on the degree of relevance of their research to agricultural use.

Comparison of alternatives for the control and detection of boar taint in market hogs

Brian Sullivan, Brianna Sullivan and Laurence Maignel, Canadian Centre for Swine Improvement

WHY NOT JUST KEEP CASTRATING?

Castration of piglets is a common practice in Canada, as in many other countries, to avoid boar taint in pork meat. There is, however, a growing interest in raising non-castrated males for animal welfare reasons and because intact males are more growth efficient than castrates. Sexual odors are caused by the accumulation of androstenone and skatole in adipose tissues. Androstenone is a steroid produced in the testicles at the onset of puberty and plays the role of a pheromone. Skatole is a result of the bacterial degradation of tryptophan in the intestine. Genetic selection to reduce sexual odors to a level acceptable to consumers is a potential solution to this problem. Past studies have demonstrated that the two compounds responsible for these sexual odors are moderately to highly heritable, suggesting that selection to reduce these odors in intact males is possible. Research led by Dr. E. James Squires at the University of Guelph has identified genetic markers associated with sexual odors, located on genes that code for the enzymes involved in the synthesis and degradation of androstenone and skatole. Research on these markers has suggested that they could be used to lower boar taint without adversely affecting reproductive traits. One objective of this study was to evaluate the potential of selection based on these genetic markers to reduce levels of androstenone and skatole in fat tissues in Canadian hogs. With this in mind, three commercial trials (two in Quebec and one in Manitoba) were conducted to determine if the selection of terminal boars, based on their genetic potential for sexual odors, had an impact on problematic odors in commercially bred offspring. If the industry is to consider the possibility of raising intact males, there are also important implications for cost of production and the type of carcasses produced. Therefore, a second objective was to compare performance and carcass attributes of the intact males with other sex groups. A third objective was to explore options for detection of boar taint in commercial packing plants. An effective and practical way to verify the absence of boar taint is important for assurance that pork from males meets customer expectations.

Table 1– Adjusted Averages, by sexual type, for principal traits measured between 30 and 130 kg (Quebec trials)

Trait	Unit	Number of pigs	F	Sexual Type [1] C	I	M	P [2]
Average Daily Gain	g/d	617	1 002a	1 063b	1 149c	1 080b	***
Average Daily Consumption	kg/d	622	2.50a	2.76b	2.74b	2.45a	***
Feed conversion ratio (feed/gain)	kg/kg	621	2.51a	2.60b	2.40c	2.28d	***
Carcass Weight	kg	611	104.6a	104.3a	102.4b	104.0a	***
Carcass Yield	%	616	81.9a	81.5ab	79.9c	81.3b	***
Back Fat (ultrasound)	mm	620	14.6a	17.0b	15.9c	14.0a	***
Muscle Thickness (ultrasound)	mm	620	70.3 a	69.4 a	69.2 a	69.3 a	-
Lean Yield	%	616	61.8a	60.8b	60.3b	61.7a	***
Loin Eye Area	cm2	590	54.6a	50.8b	50.7b	52.8ab	***
Colour Score (loin)	points	614	4.33a	4.22a	4.21a	4.54b	***
Marbling Score (loin)	points	614	2.42a	2.65b	2.52ab	2.19c	***
24-hour pH (loin)	pH units	611	5.74a	5.74a	5.75a	5.79b	***
Water Loss (loin) – log scale	%	613	0.87a	0.66b	0.77ab	0.77ab	***
Androstenone – log scale	g/g	608	-2.16a	-2.22a	-2.09a	0.39b	***
Skatole – log scale	ng/g	608	2.01a	1.99a	2.11a	3.54b	***

1 Codes for sexual type: F=females, C=castrated males, I=Improvest® treated males, M=intact males; averages affected by the same letter (a, b, ab) are not significantly different (P > 0.05);

2 *** P < 0.001; ** P < 0.01; * P < 0.05; t P < 0,10

Table 2 – Adjusted Averages, by sexual type, for principal traits measured between 30 and 130 kg (Manitoba trials)

Trait	Unit	Number of pigs	F	Sexual Type [1] C	I	M	P [2]
Average Daily Gain	g/d	1 056	935a	995b	1 054c	997b	***
Average Daily Consumption	kg/d	1 056	2.54a	2.90b	2.97b	2.53a	***
Feed conversion ratio (feed/gain)	kg/kg	1 056	2.71a	2.91b	2.82b	2.54c	***
Carcass Weight	kg	89	109.1a	109.8a	108.5ab	106.3b	**
Carcass Yield	%	89	80.4a	81.0a	80.0ab	78.4b	**
Back Fat (ultrasound)	mm	242	17.9 a	19.3 a	20.8 a	17.0 a	t
Muscle Thickness (ultrasound)	mm	242	71.7a	67.5ab	66.7b	69.8ab	*
Lean Yield	%	89	63.5ab	62.2bc	61.8c	64.6a	***
Loin Eye Area	cm2	89	67.2 a	64.1 a	62.7 a	63.7 a	-
Colour Score (loin)	points	89	2.51 a	2.46 a	2.44 a	2.56 a	-
Marbling Score (loin)	points	89	1.70 a	1.91 a	1.91 a	1.62 a	t
24-hour pH (loin)	pH units	89	5.70 a	5.74 a	5.71 a	5.74 a	-
Water Loss (loin) – log scale	%	89	0.51 a	0.43 a	0.64 a	0.71 a	-
Androstenone – log scale	g/g	280	-1.59a	-1.63a	-1.65a	1.38b	***
Skatole – log scale	ng/g	280	1.46a	2.14a	2.05a	3.56b	**

1 Codes for sexual type: F=females, C=castrated males, I=Improvest® treated males, M=intact males; averages affected by the same letter (a, b, ab) are not significantly different (P > 0.05);

2 *** P < 0.001; ** P < 0.01; * P < 0.05; t P < 0,10

COMMERCIAL TRIAL RESULTS FOR GILTS, CASTRATES, IMPROVEST® TREATED MALES AND INTACT MALES

Duroc boars active in three Canadian artificial insemination centres were genotyped for 103 genetic markers and ranked on their genetic potential for boar taint levels. A total of 1,660 commercial pigs born from boars with either low or high potential for androstenone were raised from weaning to slaughter in commercial trials. Two trials were carried out in Quebec (Table 1) and one in Manitoba (Table 2). Each trial included females (F), castrates (C), intact males (M) and Improvest® treated males (I). The pigs were tested from 30 to 130 kg live weight and tracked at the packing plant for carcass and meat quality measurements. Results show sex differences in line with those in the literature for live performances, including a faster growth for I animals due to a higher feed intake, whereas intact males showed the best feed efficiency, followed by F animals, then C and I. Lean yield was higher in M and F compared to C and I. Loin muscle area was higher in F compared to the three male groups. There were significant differences found in the Quebec trials for loin marbling, colour, pH and water loss. These were not significant in the Manitoba trial, possibly due to smaller numbers of loins evaluated. Androstenone and skatole levels on average were similar and low in F, C and I, while being significantly higher in M, as expected. Large differences were seen between trials for boar taint levels and thus environment and management will be important considerations for avoiding boar taint in intact males.

POTENTIAL FOR GENETIC SELECTION TO ELIMINATE BOAR TAINT

Differences between high and low boar taint groups were in the expected direction for androstenone and skatole levels in fat tissue. In other words, the litters sired by the low boar taint Durocs had a higher percentage of intact males with androstenone and skatole with acceptable levels for consumers. This was the case in both the Quebec and Manitoba trials. However, the differences were relatively low and not significant in most cases. The results are, nevertheless, encouraging considering this study was with limited numbers of intact males and only considered the effect of the terminal sire (Duroc) on boar taint. Evaluation in maternal breeds (Yorkshire and Landrace) can also be considered. Further, during the course of this study, many new genetic markers have been identified. Genetic evaluation methods for boar taint will be enhanced with the use of additional genetic markers and a better understanding of mechanisms involved in crossbred animals. This additional research is expected to increase accuracy of genetic evaluation and allow for a better assessment of genetic selection as a potential alternative to control boar taint. Additional commercial validation trials should be conducted which could also consider behaviour and welfare aspects of raising intact males.

DETECTION OF BOAR TAINT IN COMMERCIAL HOGS

Two methods for detection of boar taint were tested against reference chemical analysis for androstenone and skatole. The first method was the human nose with trained panelists, a method currently used in slaughter plants in the European Union. Trained panelists evaluated batches of fat samples in several monthly sessions in a lab, or "protected", environment. The panelists were able to differentiate high from low boar taint in 65 to 92% of samples, depending on the month. The second method was a novel approach using DNA aptamers, which are single strands of DNA that fold into unique shapes depending on the DNA sequence. Research led by Dr. Maria DeRosa at Carleton University went through a process to find and select aptamers that bind well and exclusively to skatole and androstenone. The next step was the development of a lateral flow assay, similar to a pregnancy test strip. In a preliminary trial using the lateral flow assay, the DNA aptamers gave correct results on 14 of 15 samples. Further validation is planned and options for development of DNA aptamer test kits for commercial use are being considered.

(Comparison of Alternatives ... cont'd on page 11)

Gestation housing systems

Auditing Best Management Practices - Part 4

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.

Converting to group sow housing systems is a major challenge and opportunity currently facing Canadian pork producers. In order to provide more information to producers and to help them make the conversion by the 2024 deadline, this article focuses on best management practices related to various gestation housing systems.

Of the 24 farms audited in 2017, 21 of them included sows either as a farrow-to-finish or farrow-to-wean facility, while the other three operations were finishing only. Of these 21 farms, nine incorporated some type of group sow housing system, while the remaining housing systems would be considered traditional stall systems.

Based on meetings held as part of the National Sow Housing Conversion project, it would be estimated that nation-wide 15% of gestating sows would be kept in a group housing system. The one exception would be Quebec, where approximately 25% of sows would be housed in a group housing system.

Figure 1 provides details on the nine farms that have made the transition to group sow housing including the type of group housing system implemented on the farms. Two thirds of the farms have chosen a non-competitive system such as an electronic sow feeder or free-access system, while the balance of producers have chosen a competitive feeding system. In speaking with producers, the decision to proceed with a direct competitive feeding system is typically based on a cheaper cost of conversion, while those choosing electronic sow feeding systems are utilizing data collection as a herd management tool.

One opportunity that most electronic feeding systems offer is the ability to feed multiple gestation diets across the sow herd. Research looking at the nutritional management of sows found that amino acid and energy requirements of sows strongly support the need for parity-segregated phase feeding of pregnant sows.[1] Phase feeding programs should consist of two diets that satisfy the highest and lowest amino acid requirements and can be mixed in appropriate

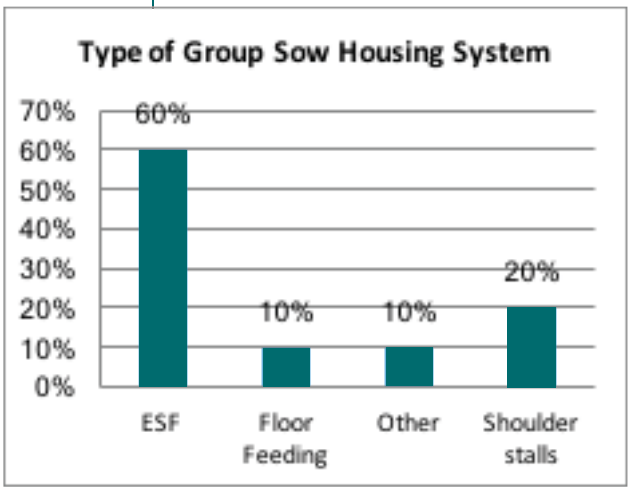


Figure 1. Types of group sow housing system implemented.

Table 1. Audit results from farms with group sow housing systems, 9 farms

Category	Average Percentage of Farms		
*Are all Sows fed same gestation diets**	*21 %*	*79 %*	*0 %*
Time of Group Formation	*100 %*	*0 %*	*0 %*
Sows are Sorted by Size (room or pen)	*100%*	*0%*	*0%*
Type of enrichment used	*88 %*	*13 %*	*0 %*

Legend
- Meets recommendation
- Partially meets recommendation
- Does not meet recommendation

ratios to cover the intermediate amino acid needs, with increasing amounts fed the last four weeks of gestation. The biggest challenge regarding the implementation of this strategy is to ensure a minimum of two feed lines are available for each electronic feeding station. As seen by the results in Table 1, only one farm has adopted this technology.

Timing of group formation is essential for ensuring high productivity from the sow herd. Groups should be formed prior to day 7 or after day 28 due to the importance of implantation. Results indicate that 100% of farms were compliant. Feedback from producers involved in the group sow housing process also indicates that they are becoming more comfortable mixing sows earlier than day 7 which, in turn, reduces the total number of stalls required on the farm. Research on the grouping of sows in non-competitive housing shows there are benefits to keeping sows in uniform groups, especially for younger sows. Sows in uniform groups demonstrated less instances of lameness after mixing compared to sows kept in mixed (non-uniform) groups[2].

Within the Code of Practice for the Care and Handling of Pigs (2014)[3], enrichment is considered to be a recommended practice within group sow housing systems, specifically as a way to minimize aggression. Taking a look at the data we can see that eight of nine farms audited have incorporated some type of enrichment, typically chains or wood, within their operation. According to the Code, enrichment should be simple, safe, soft, sanitary, suspended and well-positioned. More information can be found in Appendix H within the Code.

Conclusion

Data indicates that approximately 15% of the Canadian sow herd has made the transition to group sow housing. For those producers looking to make the transition, many resources can be accessed at your fingertips by visiting the website www.groupsowhousing.com. Here you will find a wide variety of information that will help you make the best choice possible for your operation.

For Further Reading

1 Phase Feeding for Gestation Sows
(Francais) http://www.cdpq.ca/getattachment/Recherche-et-developpement/Projets-de-recherche/Projet-224/PQ-juillet-2017-224.pdf.aspx
http://www.cdpq.ca/recherche-et-developpement/projets-de-recherche/projet-224.aspx
(English) http://www.cdpq.ca/getattachment/Recherche-et-developpement/Projets-de-recherche/Projet-224/CHJ-Summer-2017-projet-224.pdf.aspx
(English) http://www.prairieswine.com/phase-feeding-for-pregnant-sows/

2 Effects of Mixed and Uniform Parity Groups on Feeding Behaviour, Welfare and Productivity of Sows in ESF Housing
(English) http://www.prairieswine.com/effects-of-mixed-and-uniform-parity-groups-on-feeding-behaviour-welfare-and-productivity-of-sows-in-esf-housing/

3 Code of practice for care and handling of pigs
(Francais) http://www.nfacc.ca/pdfs/codes/porcs_code_de_pratiques.pdf
(English) http://www.nfacc.ca/pdfs/codes/pig_code_of_practice.pdf

(Comparison of Alternatives ... cont'd from page 9)

TAKE HOME MESSAGES

Many recent studies have compared intact males and castrates, or castrates and Improvest® treated males. This study is rare in that it includes females, castrates, Improvest® treated males and intact males from the same litters, all tested under similar conditions. These comparisons provide valuable information on differences that can be expected for both producers and packers to plan for and make decisions related to options for control of boar taint.

This study confirmed the advantages of raising intact males in terms of growth performance compared to females and castrates. Improvest® treatment is an interesting option because it gives the benefit of improved growth performance of intact males while producing carcasses of similar composition to castrates.

Genetic selection based on specific genetic markers shows potential for producing intact males with naturally low enough levels of androstenone and skatole to avoid boar taint problems. However, more research is needed on genetic evaluation methods, consideration of influence of genetics from the maternal breeds and to incorporate newly identified genetic markers. The impact of management and environment also needs to be considered as large differences in the levels of boar taint were observed between trials. The combination of management and genetics could result in lower and lower probability of carcasses from intact males having boar taint.

A new technology based on DNA aptamers shows great promise to lead to a reliable, practical and affordable screening test for boar taint. This could be in the form of a simple kit similar to a home pregnancy test available for humans. The ability to screen for boar taint combined with genetic selection to lower the frequency of intact males that have boar taint problems could lead to a viable alternative for control of boar taint.

ACKNOWLEDGEMENTS

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Personal Profiles

Dr. Murray Pettitt

Dr. Murray Pettitt has been appointed as the new CEO of Prairie Swine Centre. Murray has been part of the swine research community for the past 19 years, and was previously employed at Prairie Swine Centre (PSC) for 10 years, managing Contract Research from 2003-2009. During that time he grew the program's size and capabilities, while being responsible for the business development as well as the design and implementation of customer-driven research.

Murray is from rural Manitoba and received his BSA in 1986 and his M.Sc. in animal reproduction in 1991 from the University of Manitoba. After three years at the Winnipeg Health Sciences Centre, he returned to agriculture to pursue research in boar sperm cryopreservation at the University of Guelph, receiving his Ph.D. in 1997. Murray then accepted a post-doctoral fellowship at the Ontario Veterinary College where he helped develop practical embryo transfer techniques in swine.

In 1999, he assumed the position of Assistant Manager – External Research Services (also known as Contract Research) at PSC. Subsequently he became the Research Scientist – External Research Services from 2003 – 2009 where he was responsible for leading this program conducting confidential, proprietary contract research on behalf of corporations, associations or individuals in the swine industry in a professional, business environment.

Since leaving PSC, Murray has been at the Department of Animal and Poultry Science at the University of Saskatchewan where he was responsible for managing a research program investigating markers of sperm function to identify the fertility potential of boars and bulls.

"It is like coming home - to be able to return to the Centre after 9 years pursuing my research interests in my area of specialization" notes Murray. "The position of CEO will enable me to further my interests in bringing science to agriculture, further strengthen our relationships with the pork industry and other researchers, and develop new relationships and collaborations in order to add to the long, successful history of Prairie Swine Centre's service to the pork industry".

Hydrogen Sulphide AWARENESS TRAINING

Prairie Swine Centre has developed an on-line course for individuals involved in the hog industry to take from the convenience of their staff room.

The on-line course takes you through six Modules covering the areas of: Properties, Exposure limits, Hazardous locations, Videos, Case studies and dealing with emergencies.

For more information please contact ken.engele@usask.ca

Coming Events

Alberta Livestock Expo
October 10, 2018
Lethbridge, Alberta

Red Deer Swine Technology Workshop
October 24, 2018
Red Deer, Alberta

Saskatchewan Pork Expo
November 14-15, 2018
Saskatoon, Saskatchewan

Prairie Livestock Expo
December 12, 2018
Winnipeg, Manitoba

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