Prairie Swine Centre

Prairie Swine Centre – a unique and focused approach to production research

By Lee Whittington, President/CEO

PRAIRIE SWINE CENTRE
Research Profits Everyone

Prairie Swine Centre (PSC) is a non-profit research and technology corporation, affiliated with the University of Saskatchewan, focused on using science to improve our understanding of the pig. PSC is equally a communications company, building networks with industry, academia and government to ensure this knowledge benefits the industry, its people, pigs and the environment. The Centre combines expertise in behaviour, nutrition, engineering, health, management, economics, contract research, and consulting to address multi-disciplinary challenges faced by modern pork production. Our mission at the Centre – *"We provide solutions through knowledge, helping to build a profitable and sustainable pork industry".*

Weaning is a stressful time in a piglet's life. They undergo social, environmental and nutritional stressors at a time when their immune system is not fully developed.

The research program, with a decidedly near market emphasis, creates information to improve the financial position of pork producers by defining for example, feeding and management systems that maximize net income. This emphasis on economic impact of new technology and management is evident in the research reports, presentations and farm consultations the Centre's staff produce. A review of the last ten years of research results shows that each year the Centre adds $3.60 per pig in increased net income to farms which adopt our most recent research.

Prairie Swine Centre was originally built in 1980 by the University of Saskatchewan, and served as their swine research and teaching facility. In 1991 the Centre took a bold new direction, partnering with industry and developing a new business model for applied research with direct investment from industry and government. Today the Centre boasts modern swine production research facilities of over 94,000 square feet located near Saskatoon, SK, a staff of seven PhD scientists, the ability to attract graduate students from around the world, and funding from over 30 different agencies. Through collaborations and research partnerships the Centre conducts research in diverse swine facilities, ranging in size from 330 to 6,000 sows, using large and small groups, individually housed and group-housed sows, and a variety of health status herds across North America. These research efforts seek to address challenges throughout the pork value chain from production to transportation and meat quality.

Developing qualified people for industry and academia is just as important as new knowledge. Since inception, the Centre

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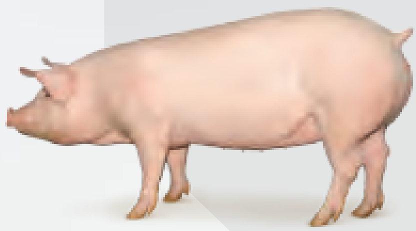

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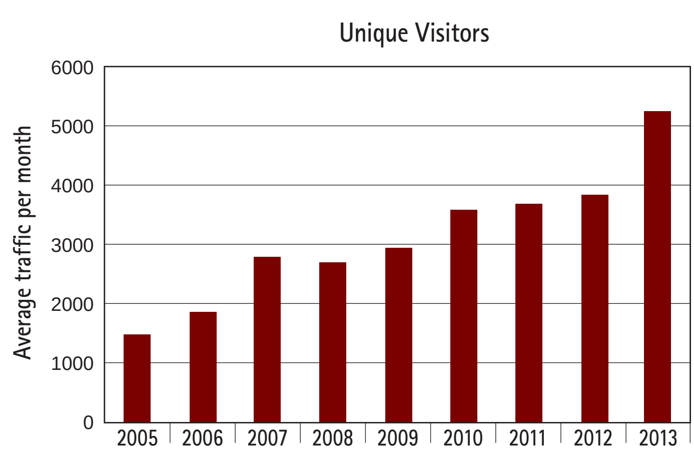
has developed 50 graduate students who are playing important roles in furthering industry development. Many research scientists and associates made their mark at PSC and went on to develop research programs, or are employed in related businesses and government support positions.

Pork producers will recognize our research scientists who regularly speak at meetings across Canada as part of our technology transfer program that brings the newest science right up close. We feel some of the most productive meetings are not necessarily the large meetings, but actually are the workshops for 12-20 people where questions, answers and challenges can be addressed directly. We look forward to these meetings, engaging with producers, feed, pharmaceutical and genetics representatives, processors and truckers, because it is here that the new information can be tested and challenged and modified so that it makes dollars and cents to implement.

Our personnel are asked to speak nationally and internationally at scientific symposiums as well as at industry conferences because the research is applicable, and because there is so much activity. Our typical year sees a new experiment started every 9 to 11 days! This level of activity contributes to one of our key measurables, which is the number Research Conclusions developed over the year. We challenge our teams to look not just at results but the application of the data – "what do we know this year that we didn't know last year?" – this is a true research conclusion with impact. From these we use our enterprise model to estimate the effect of net income from each Research Conclusion. This combined knowledge of research data, application and economics is what drives the technology transfer program and tells the story of how to adopt it on the farm, in the transport truck or at the packing plant.

Our website tells the story of how important this knowledge is. We measure 'unique users', a measure of website activity that only counts each IP address once per search session when they come to PSC's website. In spite of the declining numbers of pork producers, the activity has steadily grown, coming to the website with questions as diverse as "How many pigs should eat from a feeder?" to "What is the correct diet energy level to maximize net income?" The graph below shows nine years of steady growth of visitors to the website.

Our Vision – To be an internationally recognized source of original, practical knowledge, providing value to our stakeholders throughout the pork value chain. ■



Prairie Swine Centre

Research in progress…

The influence of gestational diet and birth weight on bone development in piglets

Felina Tan[1,2], Saija Kontulainen[2] and Denise Beaulieu[1]

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In humans, evidence suggests that low maternal calcium intake increases the risk of reduced bone mass in neonates. In modern hyperprolific sows, maternal nutrition affects fetal growth and development, which plays a crucial role in birth weight and within-litter uniformity. Low birth weight piglets have a reduced growth rate and lower bone mass relative to normal-sized piglets, affecting their survivability and postnatal growth. The objective of this study is to determine if there is an influence of calcium (Ca) and phosphorus (P) intake by gestating sows on the piglets' growth and skeletal development.

Thirty sows were randomly assigned to one of three dietary Ca:P treatments (requirement, 15% above or below requirement) at day 28 of gestation until farrowing. Only sows with litters of 12 or more piglets remained on test. At birth,

Low birth weight piglets have a reduced growth rate and lower bone mass relative to normal-sized piglets, affecting their survivability and postnatal growth.

the smallest and a normal-sized piglet were euthanized, and the left hind limb extracted. Soft tissue surrounding the femur was removed and bone length was determined. The limb was wrapped with saline-soaked gauze and kept frozen until analysis. Specimens were transferred to the College of Kinesiology, University of Saskatchewan for scanning using the Norland/Stratec pQCT (Figure 1, XCT 2000, Stratec Medizintechnik GmbH, Pforzheim, Germany). The total and

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Figure 1: Peripheral quantitative computed tomography (pQCT) scan in the midshaft of the femur in a newborn piglet left hind limb. (Right figure: Scanned region of interest, ROI)

cortical compartment measurements were obtained, which included cross-sectional area, cortical mineral content, cortical bone mineral density and strength strain index (Figure 1). Data and statistical analysis are currently underway.

From this study, we hope to obtain a better understanding of the factors influencing the events that occur during gestation which have an impact on fetal growth and development. We believe this is important to achieve overall improved efficiency. ■

Felina Tan graduated with a DVM from University Putra Malaysia in 2010. She worked with Cargill Animal Nutrition, Malaysia as a feed formulator majoring in swine and poultry prior to joining Prairie Swine Centre in April 2012 as a graduate research assistant in nutrition. She is actively pursuing her MSc Animal Science in University of Saskatchewan, Canada. Her research focus is on the effect of dietary calcium and phosphorus on sow lameness and the impact on piglet growth and bone integrity. She will be graduating in Fall 2014.


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Assessing the interaction between stocking density and dietary energy on finishing pig performance and economic returns

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Introduction

The negative effect of reduced space allowance on growth is usually a consequence of reduced nutrient intake. We hypothesized that increased dietary energy concentration will reduce the negative effects of crowding, and that the optimal dietary energy concentration which maximizes net income will depend on stocking density. Understanding the relationship between dietary energy and stocking density will help pork producers maximize their return on investment.

Materials and methods

A total of 18 treatments arranged as a 2 x 3 x 3 factorial included: gender (barrows and gilts), dietary energy (2.15, 2.3 and 2.45 Mcal NE/kg) and stocking density (14, 17 or 20 pigs/pen providing 0.92, 0.76 and 0.65 m2 [9.97, 8.20 and 6.98 ft^2] per pig, respectively). Three replications of the 18 treatments were completed using 918 pigs (Camborough Plus dam x line 337 sire PIC Canada Ltd.; Winnipeg, MB).

Animals and Environment

The experiment was conducted at the Prairie Swine Centre (Saskatoon, SK) in fully slatted rooms, 14m by 10.8m containing 10 rectangular (4.8m by 2.7m) pens. Each pen contained two single space wet-dry feeders (Crystal Springs Hog Equipment; St. Agathe, MB, Canada) providing 0.22 m^2 of feeder space per pen. The feeders were the only source of water.

Pigs were selected to ensure typical barn variation and were started on test at an average of 75kg BW but with a range of 60 to 90 kg BW. They were marketed weekly when they reached a BW of 115 kg (Thunder Creek Pork Inc., Moose Jaw, SK).

There were four sets of diets with three dietary energy levels within each diet set (Table 1). The first three diet sets were fed as the three phases for gilt and diets 2-4 were used as the three phases for barrows.

Diets (Table 1) were formulated to meet or exceed nutrient requirements (NRC 2012). Diets were available *ad-libitum* but weighed daily when added to the feeder.

Space allowance was calculated by using an allometric equation □ = □ ÷ $BW^{.667}$, where "A" represents area (m^2), k is a space allowance coefficient, and $BW^{.667}$ is the metabolic body weight. The k-value of 0.0336 was used to define crowding (Table 2) which occurred at about 85 and 108 kg BW with 20 and 17 pigs per pen respectively.

Results and Discussion

Overall, as dietary energy increased feed intake was reduced, caloric intake increased, growth rate was increased and feed efficiency improved (Table 3). The response however, differed by gender. Gilts increased feed intake by 9.9% as dietary energy decreased from high to low (data not shown) however, caloric intake was decreased slightly in gilts fed the low energy diet. Dietary energy concentration did not affect growth rate in the gilts. In barrows however, feed intake increased by only 6.8% as dietary energy concentration decreased, caloric intake decreased and growth rate was not maintained (data not shown).

Stocking 14 pigs/pen did not improve pig performance when compared to the pen of 17, presumably due to minimal crowding in the pen of 17 (Table 3). However, when stocking density was increased to 20 pigs/pen, feed intake and ADG were reduced.

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Table 1. Ingredient and nutrient composition of the diets formulated to contain 2.15 and 2.45 Mcal of NE/kg fed to both genders in this experiment. The 2.30 concentration was the intermediate (as-fed basis)[1,2]

Diet	1		2		3		4	
Gilts	75-90 kg		90-105 kg		105-118 kg			
Barrows			75-90 kg		90-105 kg		105-118 kg	
	Dietary Net Energy (Mcal/kg)							
Item	2.15	2.45	2.15	2.45	2.15	2.45	2.15	2.45
Barley	48.83	5.79	54.84	30.36	66.55	50.27	68.8	61.81
Wheat	-	50.06	-	28.66	-	18.64	2.94	15.00
Millrun wheat	20.00	20.00	20.00	20.00	14.41	15.00	5.00	10.00
Peas	18.97	18.66	14.47	15.00	7.70	10.0	6.65	7.33
Oat hulls	7.37	-	7.89	-	8.53	-	13.08	-
Canola meal	2.00	-	-	-	-	-	-	-
Limestone	0.91	1.08	0.86	0.99	0.83	0.95	0.70	0.88
Tallow	0.50	2.80	0.50	3.41	0.50	3.57	1.37	3.45
L-Tryptophan 98%	0.01	-	-	-	-	-	-	-
Lysine HCL 78%	0.19	0.32	0.21	0.30	0.26	0.31	0.25	0.30
L-Threonine 98%	0.08	0.12	0.09	0.12	0.10	0.12	0.10	0.11
DL-Methionine 98%	0.03	0.05	0.02	0.04	0.01	0.03	-	0.01
Calculated composition								
ME, Mcal/kg	2.95	3.24	2.93	3.24	2.91	3.22	2.90	3.21
SID lysine g/Mcal of NE	3.23	3.23	2.97	2.97	2.73	2.73	2.52	2.52
Ca, %	0.60	0.60	0.56	0.56	0.53	0.53	0.50	0.50
P, %	0.25	0.25	0.24	0.24	0.23	0.23	0.23	0.23

[1]All diets were formulated to meet requirements for pigs of each phase (NRC 2012)
[2]Contain the same amount of vitamin, mineral, choline, salt, and ronozyme (phytase)

Table 2. Space allowance and k-value for each stocking density at various weights throughout the finishing period (75-118 kg BW, crowding defined as a k-value≤0.0336)

		Stocking Density		
Area/pig (m^2)		14	17	20
		0.93	0.76	0.65
		k-value		
BW (kg)	75	0.0520	0.0428	0.0364
	85	0.0478	0.0394	**0.0335**
	108	0.0405	**0.0334**	0.0284
	118	0.0384	0.0316	0.0269

Feeding the high energy diet reduced days to market (75-118 kg BW), and increased barn throughput by 1.6% (Table 4). Despite the improvement in feed efficiency, feed costs were 11% higher with the high energy diet. There was no effect of dietary energy on carcass margin/pig. The improvement in barn throughput resulted in a tendency for increased income over feed cost (IOFC) with the high energy diets.

On a per pig basis, the pen of 20 had the lowest feed cost per day, but required 1.6 more days to reach market weight (118 kg BW) and there was no difference in total feed cost to reach market weight. Barn throughput increased by 40% when stocking density increased from 14 to 20 pigs per pen. There was no effect of stocking density on carcass value. The increase in barn throughput and no difference in feed cost to reach market weight, resulted in stocking density being the most important factor in determining IOFC. As stocking density increased there was a linear improvement in IOFC (Table 4).

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Table 3. Main effects of stocking density and dietary energy concentration on ADG, ADFI, G:F, caloric intake, and caloric efficiency from 75-118 kg BW [1,2,3]

	Stocking density			Diet regimes				*P*-value[4]	
	Pigs per pen (NP)			Dietary NE (Mcal/Kg)					
Item	**14**	**17**	**20**	**Low**	**Medium**	**High**	**SEM**	**Stocking**	**NE**
ADFI, kg[5]	4.00[a]	3.97[a]	3.82[b]	4.09[a]	3.92[b]	3.77[c]	0.08	<0.001	<0.001
ADG, kg[6]	1.21[a]	1.21[a]	1.17[b]	1.17[a]	1.21[b]	1.23[b]	0.03	0.05	0.005
G:F[7]	0.30	0.31	0.31	0.29[a]	0.31[b]	0.33[c]	0.004	0.61	<0.001
Caloric intake, Mcal/d[5]	9.19[a]	9.12[a]	8.12[b]	8.81[a]	9.02[b]	9.29[c]	0.17	<0.001	<0.001
Caloric efficiency, Mcal:Gain	7.59	7.52	7.52	7.54	7.49	7.59	0.09	0.69	0.63

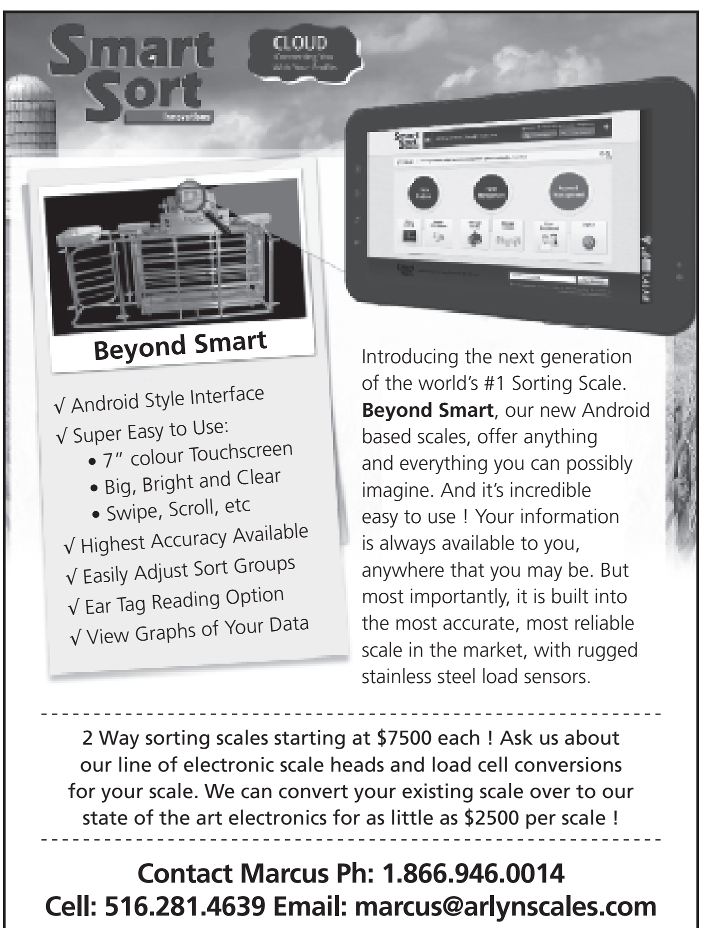
[abc] Within a row and treatment, means without a common superscript differ ($P<0.05$)
[1]Data presented on an as fed basis [2]Quadratic contrasts were not significant [3]Dietary energy x stocking density ($P > 0.10$)
[4]P-values: stocking= stocking density, NE= dietary net energy [5]Gender x stocking density ($P < 0.10$) [6]Gender x dietary energy ($P< 0.05$) [7]Gender x dietary energy ($P< 0.10$)

Table 4. Main effects dietary energy concentration and pen density on barn throughput, carcass revenue, feed cost, and IOFC [1,2,3]

	Stocking density			Diet regimes				*P*-value[3]	
	Pigs per pen (NP)			Dietary NE (Mcal/Kg)					
Item	14	17	20	Low	Medium	High	SEM	Stocking	NE
Days to market[4]	35.4[a]	36.0[ab]	37.0[b]	36.9[a]	36.0[ab]	35.5[b]	1.3	0.03	0.06
Finisher rotations[5]	3.47[a]	3.45[ab]	3.41[b]	3.42[a]	3.45[ab]	3.47[b]	0.41	0.03	0.05
Barn throughput[6,7]	48.5[a]	58.6[b]	68.3[c]	58.0[a]	58.5[ab]	58.9[b]	0.7	<0.001	0.02
Carcass revenue/pig[8]	134.33	135.36	133.08	133.08[a]	134.35[ab]	136.10[b]	1.39	0.50	0.08
Feed cost/pig, CDN $[7]	30.66	30.91	30.71	29.85[a]	30.57[a]	31.86[b]	1.04	0.86	<0.001
Feed cost per kg gained, CDN $ [9,12]	0.73	0.72	0.72	0.70[a]	0.72[a]	0.75[b]	0.01	0.82	<0.001
Feed cost pig/d, CDN $[10,13]	0.87[a]	0.86[a]	0.83[b]	0.81[a]	0.85[b]	0.90[c]	0.02	0.002	<0.001
Feed cost/pen, CDN $[4]	429.48[a]	525.49[b]	614.14[b]	508.70[a]	520.31[a]	540.11[b]	16.76	<0.001	<0.001
Carcass margin/pig CDN $	103.40	104.19	102.89	102.98	103.50	104.01	1.58	0.67	0.78
IOFC CDN $[11,12]	5012.50[a]	6102.50[b]	7015.90[c]	5950.83	6052.26	6127.81	141.37	<0.001	0.22

[abc] Within a row and treatment, means without a common superscript differ (p<0.05)
[1]Dietary energy x stocking density (P > 0.10) [2]Feed prices based on Saskatoon, SK 5 year average grain prices (2009-2013) [3]P-values stocking= stocking density, NE= dietary net energy
[4]Days to market from 75-118 kg BW [5]Finisher rotations= 365/(days to market +(70 day constant for all treatments 20-75 kg BW)) [6]Barn throughput= finisher rotations x pigs per/pen
[7]Value calculated from 75- market wt. [8]Carcass revenue based on a 5 year average Saskatchewan carcass price (2009-2013) [9]Feed cost per/kg gained = F:G x cost per tonne
[10]Feed cost per pig/d = ADFI x cost per tonne [11]IOFC= annual income over feed cost based on carcass value and barn throughput (75-118 kg BW) [12]Gender x Energy (P < 0.10) [13]Gender x Energy (P < 0.05)

In this study, as space allowance decreased, there was a linear reduction in caloric intake and growth. The restriction in nutrient intake in our experiment resulted in the growth reduction which suggests that if pigs were able to maintain a comparable caloric intake at higher stocking densities, effects on growth would be reduced.



Overall there were no interactions between dietary energy concentration and stocking density in our study. We observed a similar response to dietary energy at all stocking densities. The negative effects of a high stocking density on performance were not mitigated by dietary energy.

Implication

The dietary energy which maximized IOFC did not differ with stocking density.

Acknowledgements

Funding for this project was provided by Gowans Feed Consulting and Agriculture and Agri-Food Canada through the Canadian Agriculture Adaptation Program administered by the Agriculture and Food Council of Alberta. Program funding provided by Saskatchewan Pork, Saskatchewan Ministry of Agriculture, Manitoba Pork Council, Alberta Pork, and Ontario Pork

Garrett Rozeboom grew up on a small farm in Michigan and obtained a B.Sc. from the University of Minnesota in 2011. He is currently a MSc candidate at the University of Saskatchewan with a focus on swine nutrition and production. Garrett is the inaugural student in the Gowans Student Assistantship. In this program, Gowans Feed Consulting have partnered with the Prairie Swine Centre to offer graduate students the opportunity to combine their studies with practical training and industry experience. ■

Prairie Swine Centre

Omega fatty acids can affect nursery pig inflammatory response

Changing the dietary omega-6 to omega-3 fatty acid ratio impacts the inflammatory response and performance of nursery pigs more than just increasing intake of omega-3 fatty acids

L. Eastwood and A. D. Beaulieu, Prairie Swine Centre, Inc. Saskatoon.

Laura Eastwood, Ph.D.

Introduction

Weaning is a stressful time in a piglet's life. They undergo social, environmental and nutritional stressors at a time when their immune system is not fully developed. This can precipitate the 'post-weaning growth lag', which is characterized by animals going off feed, reduced growth rates and increased susceptibility to pathogens. Omega (ω)-3 fatty acids (FA) have many potential health benefits, including anti-inflammatory properties, and may help to mitigate the stress/inflammatory responses seen at weaning.

> **Weaning is a stressful time in a piglet's life. They undergo social, environmental and nutritional stressors at a time when their immune system is not fully developed.**

This project was designed to determine if altering the dietary ω-3 to ω-6 ratio or changing the absolute intake amount of ω-3 FA's would impact nursery pig health and performance. First, we characterized how the FA ratio and/or intake would affect the growth and performance of nursery pigs, including whole body FA and protein deposition. Secondly, we looked specifically at how the ω-3 to ω-6 ratio and intake affects the pigs' ability to mount an acute inflammatory response post-weaning.

Materials and Methods

Five dietary treatments, consisting of a control (Con; 10:1 ω-6:ω-3 , 3.5% total fat, tallow), 3 diets with 3.5% fat (plant sources) and ω-6:ω-3 ratios of 10:1, 5:1 or 1:1 (3.5/10, 3.5/5 and 3.5/1 respectively), and a 10:1 ratio diet with 5% total fat (5/10) were used. This allowed the comparison of increasing ω-3 intake at a constant ratio (10:1 ratio, 3.5% vs 5% fat) and decreasing ratio at a constant ω-3 intake (3.5% fat, 10:1, 5:1 and 1:1 ratios).

Experiment 1: Nursery Pig Performance

Newly weaned pigs (n = 300; 26 ± 2 days of age) were housed in groups of 5 per pen. Pens were assigned to one of the five diets. Pigs and feeders were weighed weekly for 4 weeks. Additionally, six pigs were slaughtered on day 0 (initial

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slaughter group) and six pigs per diet were slaughtered on day 28, allowing the calculation of whole body protein, fat and water deposition rates.

Experiment 2: Inflammatory Challenge

Individually housed, newly weaned pigs (26 ± 2 days of age; n = 100) were assigned to one of the five diets and to either a saline or LPS (15 µg/kg BW *E. Coli* lipopolysaccharide; promotes an inflammatory response) injection. Pigs were fed their assigned diets for 22 days prior to a 24 hour inflammatory challenge. Rectal temperatures were measured and blood samples were collected throughout the 24 hour challenge and analyzed for inflammatory proteins.

Results

During the nursery performance study (Table 1), increasing ω-3 amount (constant 10:1 ratio), did not affect ADFI or ADG; but when the ω-6:ω-3 ratio decreased (constant total fat)

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Table 1: Effects of altering the dietary omega-3 fatty acid amount or ratio on nursery pig performance and carcass composition

	Dietary Treatment[1]					Effect of Ratio[2] (Diet B vs. D vs. E)	
	A	B	C	D	E		
n6:n3 Ratio	10:1s	10:1	10:1	5:1	1:1		
% Fat	3.5%	3.5%	5%	3.5%	3.5%	SEM	*P* Value
ADFI (kg/d)							
d 21-28	0.97[a]	0.95[a]	0.93[a]	0.97[a]	1.13[b]	0.042	0.02
d 7- 28	0.68	0.67	0.66	0.69	0.78	0.031	0.08
d 0-28	0.56	0.55	0.54	0.56	0.63	0.025	0.11
ADG (kg/d)							
d 21-28	0.97	0.97	0.95	0.94	1.01	0.031	0.59
d 7- 28	0.48	0.49	0.48	0.49	0.51	0.016	0.65
d 0-28	0.39	0.40	0.39	0.40	0.42	0.015	0.58
G:F							
d 21-28	1.00	1.02	1.03	0.98	0.92	0.032	0.18
d 7- 28	0.71	0.73	0.75	0.72	0.68	0.023	0.38
d 0-28	0.70	0.73	0.74	0.71	0.69	0.024	0.64
Deposition Rate (g/d)							
Protein	78.45[ab]	71.07[bc]	69.27[c]	82.45[a]	74.24[abc]	3.241	0.07
Lipid	35.62	31.88	34.03	31.37	30.29	2.800	0.92
Water	328.72[ab]	300.95[bc]	298.61[c]	342.05[a]	313.01[bc]	11.520	0.06

[1]10:1s diet contains a saturated fat source whereas all other diets contain unsaturated fat sources
[2]Effect of altering the ω-3 amount (diet B vs. C) was non-significant for all parameters


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from 10:1 to 1:1, ADFI improved (0.93 vs 1.13 g/d, P = 0.02) during day 21 to 28 post-weaning. Pigs consuming the 3.5/5 diet tended to have increased protein (82.5 vs 71.1 vs 74.2 g/d, P = 0.07) and water (342.1 vs 301.0 vs 313.0 g/d, P = 0.06) deposition rates relative to those consuming the 3.5/10 or 3.5/1 diets. Lipid deposition was unaffected by treatment.

In the inflammatory challenge experiment, overall ADG and ADFI were unaffected by diet. During the challenge, the LPS pigs had lower (P < 0.01) ADFI (0.93 vs 0.40 kg, saline vs LPS) and ADG (+0.44 kg vs -0.52 kg, saline vs LPS). Rectal temp, IL-1β, IL-6 and TNFα were unaffected by diet but were increased by LPS (P < 0.01). Serum IL-8 concentration was reduced with decreasing ω-6:ω-3 ratio (16.79 vs 11.14 pg/ml; 10:1 vs 1:1; P = 0.03) but was unaffected by dietary ω-3 amount at a constant ratio. Pigs consuming the 3.5/1 diet had lower IL-8 responses relative to those consuming the 3.5/10 and 3.5/5 diets (diet × challenge P = 0.03). Additionally, the IL-8 response of pigs fed the 1:1 diet and challenged with LPS was similar to the saline injected pigs fed the 10:1, 5:1 or 1:1 diets (P = 0.09, Figure 1).

Summary and Conclusion

During the performance study, increasing the amount of dietary ω-3 fatty acids while keeping the ω-6:ω-3 ratio constant did not affect piglet growth, feed intake or carcass composition; however, when total fat was held constant, a 5:1 ratio led to improved feed intake in older nursery pigs, as well as increased protein deposition without altering lipid deposition. During the inflammatory challenge, we observed a significant reduction in interleukin (IL)-8 as the dietary ω-6:ω-3 ratio decreased, but there was no effect on IL-8 when just the ω-3 amount was altered. In addition to this, during the challenge, pigs consuming the 1:1 diet had an IL-8 response level similar to the non-challenged pigs on any diet. We hypothesize that the inflammatory response at weaning may help explain why pigs consuming the lower ratio diets had increased feed intake and improved protein deposition rates, as they did not require the additional protein to mount an inflammatory response.

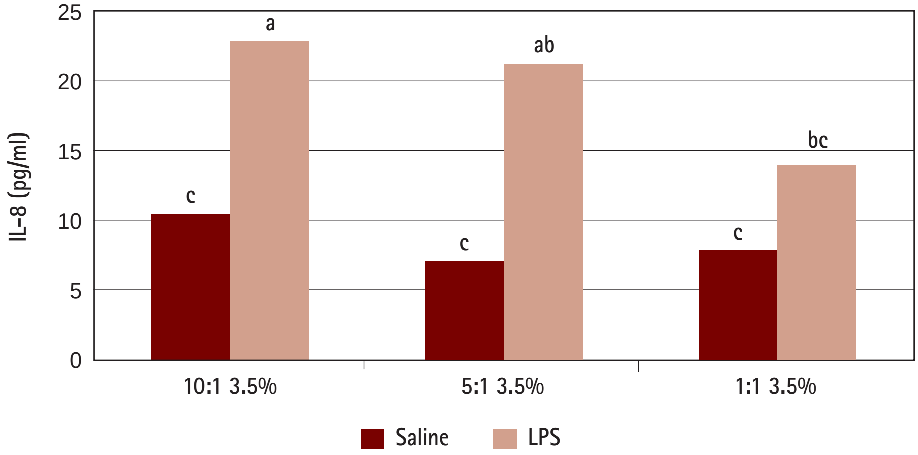
The Bottom Line

Results from these experiments indicate that altering the ω-6 to ω-3 ratio can improve nursery pig performance, and protein deposition, potentially by diverting nutrients away from an unnecessary inflammatory response. Additionally, we found no effects on piglet performance or health by altering the intake of ω-3's if the FA ratio is unchanged. Results from this project indicate that in order to observe benefits by feeding ω-3 FA's to nursery pigs, it is important to ensure the ratio of ω-3's relative to ω-6's is at least lower than 10:1. Simply increasing the amount may be ineffective. In western Canada, our wheat/barley based diets (without corn) typically contain an ω-6:ω-3 ratio of approximately 8:1 while in areas feeding ground corn the ratio could approach 20:1.

Acknowledgements

Financial support was provided by Agriculture & Food Council of Alberta, in conjunction with Agriculture Adaptation Council, Quebec Agriculture Development Council and Agriculture Council of Saskatchewan under the Canadian Agricultural Adaptation Program (CAAP). Program funding to PSCI was provided by Sask Pork, Manitoba Pork Council, Alberta Pork, Ontario Pork and the Saskatchewan Agriculture Development Fund. ■

Figure 1: Diet by challenge interaction for pigs fed decreasing ω-6 to ω-3 fatty acid ratios during an inflammatory challenge (SEM = 2.02, P = 0.09)



Prairie Swine Centre

Can group-housed sows be raised at lower temperatures to reduce barn heating costs?

Research puts sows at the helm of their own thermostat

B. Predicala, A. Alvarado, D. Beaulieu, J. Brown

Summary

In this project, an operant mechanism that will allow sows housed in a group system to control their own environmental temperature was developed. The mechanism was configured with a manual control switch that the sows can access and operate, which in turn activated the supplementary room heating system, as well as a localized radiant heater above the location of the switch as an immediate reward. Testing of a prototype system installed in a controlled-environment chamber with two sows showed that the mechanism functioned satisfactorily to allow the sows to control their environmental temperature. Preparations for subsequent tests in group-housed sow gestation rooms to assess overall heating cost savings, associated sow behavior, and optimal dietary requirements when raised at lower temperatures are underway.

Introduction

It was hypothesized that sows housed in groups can be maintained at lower environmental temperature because the sows have the opportunity to exhibit thermoregulatory behavior such as huddling when the barn temperature is lowered, thereby saving on energy to heat the barn. As such, the objective of this project was to develop a mechanism that will allow group-housed sows to operate the heating system in their airspace and maintain the environment at their preferred temperature.

An operant mechanism comprised of a manual control switch that operated the existing supplementary heating system for the sow room as well as a small radiant heater placed above the area of the switch as an immediate feedback reward was developed. The underlying principle for this operant mechanism has been successfully implemented in a study to assess the temperature preference of nursery pigs (Bench and Gonyou 2007).

Results and Conclusions

The initial design of the operant mechanism shown in Figure 1 was composed of three timers and an isolation relay. Timer one was used to supply power to and activate the isolation relay while timers two and three were used to activate the heat lamp and the room heater, respectively, over the time period set for the timer. Also, timer one was used to deactivate the push button over the time period set for the timer, to prevent extended operation of the system in case the button was activated in close succession.

At night, sows seemed to tolerate room temperatures as low as 11.5 °C while asleep.

A prototype module was assembled and installed in a controlled-environment chamber at the PSC barn. Over a two-week period, the environmental temperature in the chamber was monitored continuously using data loggers, and the sows were observed by video camera for 24 hours to assess the learning process of the sows to operate the mechanism over time, the average temperature selected by the sows, as well as operational parameters to optimize the settings of the operant mechanism.

Data gathered over the two-week testing period of the operant mechanism and the associated controls, switches and heaters showed the temperature in the room and in the inlet zone as well as the instances that the button was pressed to activate the room heating system over this 48-hr period (see Figure 2). The air coming into the chamber through the inlet had an average temperature of 8.1 °C and ranged from 6.5 °C to 9.2 °C over this period. On the other hand, the temperature inside the room was about 13.1 °C on average and ranged from 11.5 °C to 16.0 °C. The difference in temperature between the inlet and the room can be attributed mostly to the heat generated by the sows and the supplemental heat from the heaters when in operation. Validated data showed that the room temperature selected by sows ranged from 13 °C to 14 °C, with most hits on the switch occurring when room temperature was about 13.5 °C. This temperature occurred during daytime when sows were mostly awake and active. At night, sows seemed to tolerate room temperatures as low as 11.5 °C while asleep.

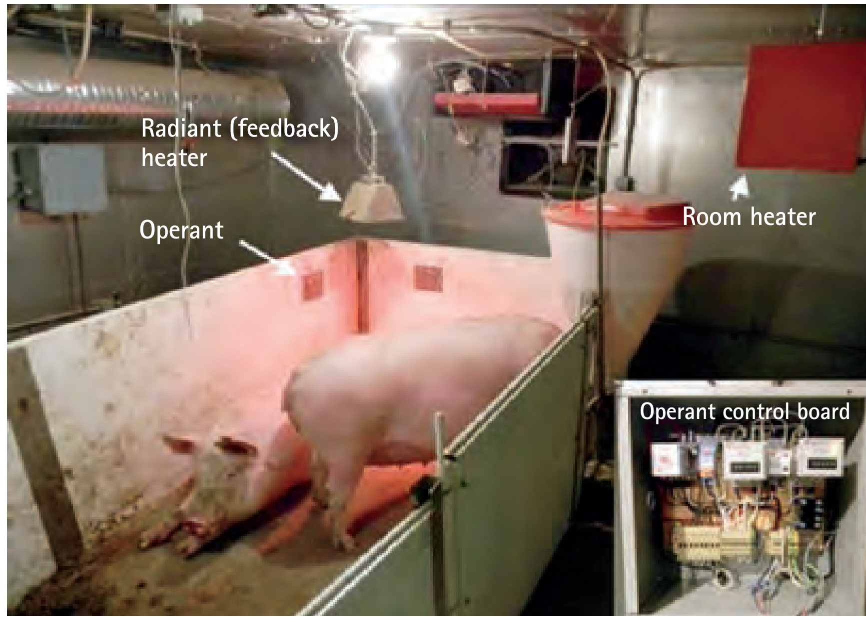


Figure 1. Experimental set-up for testing of the prototype operant module (inset) in a controlled-environment chamber.

In addition, there were instances that the temperature in the room was below 13 °C during the day and sows did not even bother to press the heat control switch.

From this work, it was shown that an operant mechanism with an accessible control switch and associated functions to allow sows to control their environmental temperature can

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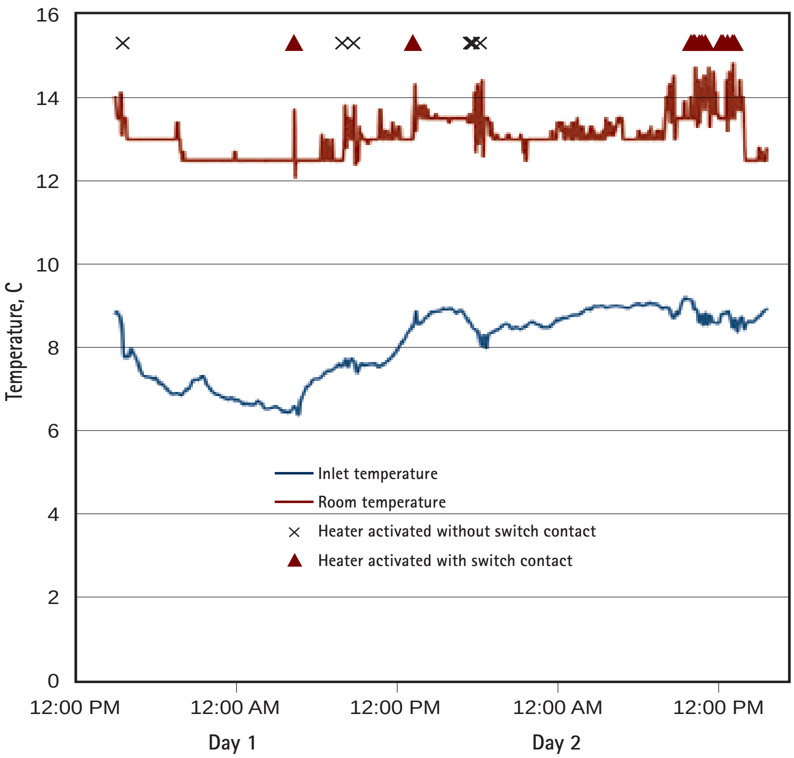
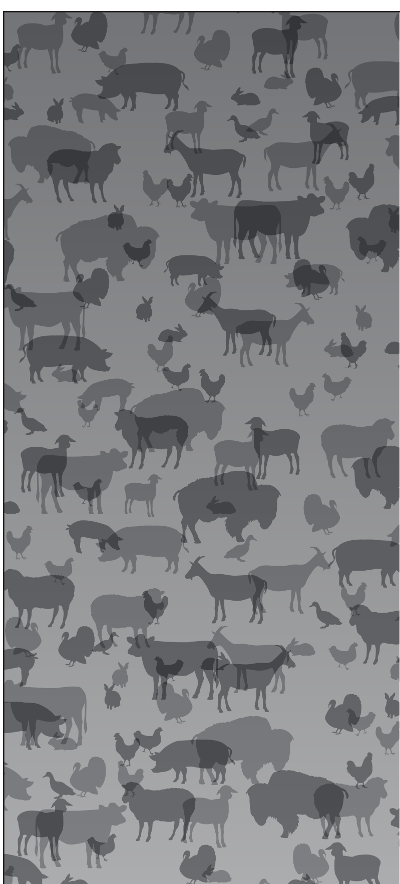
Figure 2. Measured temperature in the animal-occupied zone in the controlled-environment chamber and in the inlet zone as well as the occurrences of activation of the heating system in the room over a 48-hr period.



be successfully developed. Subsequent barn-scale studies utilizing the developed operant mechanism to determine energy savings from allowing group-housed sows to control their own environmental temperature, impacts on general activity, body condition, and weight gain of sows, and addition of high-fibre in sow diets to supplement sow metabolic heat generation, will be among the next steps.

Acknowledgements

Funding for this project has been provided by Agriculture and Agri-Food Canada through the Canadian Agricultural Adaptation Program (CAAP). In Saskatchewan, this program was delivered by the Agriculture Council of Saskatchewan. Strategic funding provided by the Saskatchewan Pork Development Board, Alberta Pork, Manitoba Pork Council and the Saskatchewan Ministry of Agriculture is also acknowledged. ■



Prairie Swine Centre

Field testing of an air filtration system for a transport trailer

B. Predicala, A. Alvarado, S. Ekanayake

Summary

The spread of airborne transmissible disease such as PRRS continues to be a serious threat to the Canadian swine industry as this disease causes significant economic losses to infected herds. This project aimed to develop an additional line of defense against infection of airborne diseases by designing an air filtration system for a swine transport trailer to maintain a pathogen-free environment inside the trailer during transport. Testing and evaluation of the prototype air filtration system showed that the use of antimicrobial filters (i.e., MERV 16 and fabric bag filters) can effectively capture bioaerosols in the air and prevent their entry into the animal compartment of the trailer.

Figure 1. Commercial swine transport trailer with installed air inlets (inset) for the air filtration system.

Introduction

The growth and success of the Canadian pork industry over the past decades depended significantly on access to highly improved genetics. High-value breeding stock produced from nucleus and multiplier farms inevitably would need to be transported to the commercial producers, thus putting these valuable genetic stock at risk of exposure to pathogens circulating in the transit areas. While individual farms have biosecurity procedures to ensure that the delivered animals are not introduced to the herd if infection was detected, the risk of infection of the breeding stock during transport can be significant, particularly during passage through pig dense areas of Quebec, Ontario and Manitoba, where disease outbreaks can still happen despite current biosecurity protocols in place. Thus, it is imperative that measures be developed to protect breeding stock during transport, thereby avoiding infection of these high-value animals and the consequent significant economic loss.

This project's overall goal was to design, develop, and evaluate an air filtration system that can be fitted to a transport vehicle to prevent infection of the high-value breeding stock during transport. The specific objectives were to fabricate and install a prototype system in an actual transport trailer, and evaluate the performance of the filtered trailer system.

Results and Discussion

An initial design which included an axial fan, air filtration system (pre-filter combined with high-efficiency filter), air inlets, and air exhaust vents with shutters was formulated based on literature review and information gathered from previous and existing filtered trailers. The components were installed on a commercial swine transport trailer (goose-neck trailer with 16' body length, 6'6" width and 6'height). The air filtration components were fitted in the gooseneck area and were operated using a forced-ventilation system (Figures 1 and 2).

The retrofitted trailer was tested for effectiveness in maintaining a pathogen-free environment inside the trailer during operation of the filtration system. A bacteriophage ϕX174 (ATCC 13706-B1) which is a benign model used as surrogate for pathogenic microorganisms in filtration studies, was used in this test.

During the actual testing and evaluation, the bacteriophage solution was aerosolized in the gooseneck area of the trailer using fogging equipment. Air samples were collected upstream (inlet side) and downstream of the filtration system (inside the trailer) using a three-piece sampling cassette with mixed cellulose filter (MF-Millipore), and a vacuum pump operated at 2.5 lpm flow rate. Bacteriophage concentrations collected on the sample filters were determined based on amplification of a specific deoxyribonucleic acid (DNA) sequence in the target organism using polymerase chain reaction (PCR) and quantitative PCR (qPCR).

Two types of air treatment filters were tested: MERV 16 with a pre-filter and antimicrobial fabric bag-type filters. Both types of filters are used in air filtered commercial barn installations.

The concentration of bacteriophage ϕX174 at the inlet area (upstream side) was reduced significantly ($p=0.002$, $n=9$) after passing through the MERV 16 filter. The average reduction relative to the upstream concentration was about 89.3%; during the tests, a few instances showed that the MERV 16 achieved a 100% reduction in bacteriophage concentration.

The effectiveness of the fabric bag filter in removing bacteriophage in the air is shown in Figure 3. Similar to MERV 16 filter, the fabric bag filters achieved significant reduction ($p=0.02$, $n=3$) in bacteriophage ϕX174 concentration. Relative to the upstream concentration, the fabric bag filters had an average reduction of about 99.8%.

Comparing the percent reduction achieved by the two filter types, MERV 16 filters were not significantly different ($p=0.695$) from the fabric bag filters.

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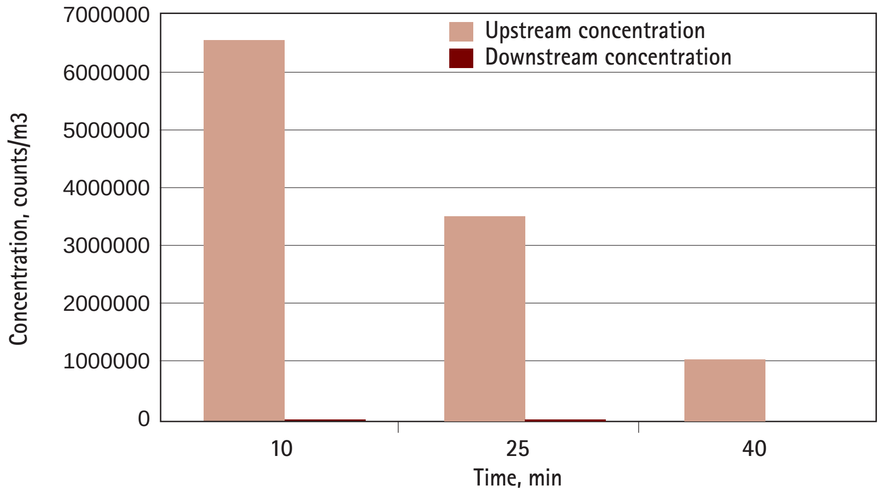
Figure 2. A ventilation fan and air filter holder were installed in the gooseneck area which was partitioned from the animal compartment of the trailer. Exhaust vents (inset) were installed on both sides of the trailer.

Figure 3. Concentrations of bacteriophage at the upstream and downstream side of the fabric bag filter.



Based on the information gathered from conducting the tests, a number of recommendations were identified to improve the operation and effectiveness of the system. These included creating more openings in the inlet as well as in the exhaust area to reduce the fan static pressure, installation of an environmental controller for better regulation of the temperature inside the trailer, and installation of a temperature monitoring system and carbon dioxide detection system with alarm function that can be detected in the truck driver cab.

Conclusions

Based on the work completed for this project, the following conclusions can be made:

1. Using information available from literature and other resources, various design components can be identified and assembled to develop an air filtration system for an existing commercial swine transport trailer to maintain a pathogen-free environment inside the trailer during transport of animals.
2. Testing and evaluation of the prototype air filtration system showed that the use of antimicrobial filters (i.e., MERV 16 and fabric bag filters) can effectively capture bioaerosols in the air and prevent entry into the animal compartment of the trailer, thereby protecting the animals from potential infection by airborne transmissible diseases during transport.

Acknowledgements

Funding for this project has been provided in part through Industry Councils from Saskatchewan, Alberta, Manitoba and Ontario, which deliver the Canadian Agricultural Adaptation Program (CAAP) on behalf of Agriculture and Agri-Food Canada. Strategic funding provided by the Saskatchewan Pork Development Board, Alberta Pork, Manitoba Pork Council and the Saskatchewan Ministry of Agriculture. ■

Gowans Feed Consulting

Gowans Feed Consulting – an introduction

Overview of Gowans Feed Consulting

Gowans Feed Consulting (GFC) was established in 1990 to provide independent nutrition, production management and cost reduction consulting services for pork producers in western Canada. Since that time, GFC has expanded its services and is currently consulting for many of Canada's leading pork and poultry producers from British Columbia to Ontario and in select international markets.

The focus of our company is to improve the net returns on customers' farms. This is achieved by:

- Providing an independent nutrition program designed to maximize income over feed and facilities cost (IOFFC);
- Employing ingredient procurement strategies and feed production expertise to decrease feed and feed manufacturing costs;
- Providing production management support to increase productivity and performance;
- Imparting and implementing the latest feeding and management technologies, as supported by a commercial style swine research facility.

In its daily undertakings, GFC endeavors to always:

- Conduct business with integrity and a long-term perspective;
- Treat clients and business partners as equals sharing a common goal of long-term prosperity.

Gowans Feed Consulting Team

The GFC team consists of seven nutritionists and three business managers. Our team consists of:

Neil Campbell, MBA, P.Ag. – Co-owner and General Manager

- Responsibilities include ingredient procurement activities and strategies for clients, feed production and quality control management, national and international business development.

Malachy Young, PhD., P.Ag. – Co-owner, Nutrition and Research

- Responsibilities include best cost formulation, farm visits and trouble shooting, production and financial data review and interpretation, and management of nutrition and research services.

Mario Ramirez, Ph.D, P.Ag. - Director of Swine Nutrition

- Responsibilities include best cost formulation, farm visits and trouble shooting, production and nutrition program direction, and international business technical support.

Traci Wautier, MSc, P.Ag. - Director of Poultry Nutrition

- Responsibilities include best cost formulation, farm visits and trouble shooting, production monitoring and review, and raw materials review.

Clarence Froese, MSc., P.Ag. – Business Development Manager, Manitoba

- Responsibilities include new business development, farm visits and trouble shooting, toll milling bids, and ingredient and complete feed pricing reviews.

Gregorio Lanz, Msc. – Swine Nutritionist

- Responsibilities include best cost diet formulation, farm visits, developing feeding programs, and nutrient/quality control database maintenance for Manitoba based clients.

Vicente Zamora, Ph.D, - Swine Nutritionist

- Responsibilities include best cost diet formulation, farm visits, developing feeding programs, and nutrient/quality control data base maintenance for western Canadian based clients.

Tom Jarrett – Business Development Manager, Ontario

- Responsibilities include new business development, farm visits and trouble shooting, toll milling bids and feed pricing reviews for Ontario based clients.

Jose Landero, Ph.D, - Swine Nutritionist

- Responsibilities include NIR program manager, supervision of GFC research facility, and data analysis and reporting.

Ralph Tuck – Business Development Manager, Western Canada.

- Responsibilities include new business development, farm visits and trouble shooting, toll milling bids, and ingredient and complete feed pricing reviews. ■

Gowans Feed Consulting

Drumloche Research Barn – A solution for commercial-scale research projects

By Gowans Feed Consulting

Introduction

A lot of new knowledge of interest for pork producers has been generated through research in swine animal nutrition, management, genetic lines, uses of new additives or technologies, etc. However, some of this knowledge has been generated in experimental conditions (i.e., number of pigs per pen, environmental challenge, etc.) very different to practical conditions seen in commercial-scale grower-finisher barns. Therefore, one of the big challenges that diffusion of new knowledge is currently facing is the pressure of showing its replicable application in commercial-scale environments. Gowans Feed Consulting, a leading independent company who provides the industry with leading expertise in swine nutrition, production management, input cost reduction and research, was involved on the design of the Drumloche commercial-scale research barn that is currently operating in Western Canada. Since its construction in 2005 by the Burdens family, a wide array of applied research projects have been conducted at the barn. Some of the projects were focused on evaluating alternative feedstuffs for swine feeding, determining nutrient requirements for pigs, energy titration, feed additives evaluations, vaccines and bore line trials among others, with the objective to reduce production costs and increase pork producer profitability. The research barn has two rooms with a capacity to house 1050 pigs in each room.

Results from this experiment clearly show that profitability per square foot increases as both water availability and stocking density increase.

Each room is serviced by six feed bins and equipped with a computer-controlled robotic feed delivery system (Feed Logic, Feed Logic Co., Willmar, MN, USA) that can dispense feed to any pen in precise quantities (maximum weight error of 0.1%). The research barn has the capacity to conduct six grow-finish experiments per year and has conducted projects of interest for pork producers in collaboration with research partners including University of Alberta, Alberta Agriculture and Rural Development, Prairie Swine Center, Sunhaven Farms, genetic companies, feed additive suppliers and many other private companies.

The commercial-scale grow-finish facility

The Drumloche Research Barn was constructed in 2005 by John Burden and family, general partner and contract grower in the Sunhaven Farms system. The facility is located near Irma, AB, about one and a half hours east of Edmonton, near Wainwright, and about one hour west of the Saskatchewan border. The barn is located on an isolated site and is situated 150 meters (492 feet) from two existing grower-finisher barns, on higher ground and upwind with a separate driveway. Since the construction of the research facility, Gowans Feed Consulting was involved with its design and signed a management contract with Drumloche Farm to manage the operation of the research barn trials. The highly skilled research team includes John Burden, Neil Burden and Tanya Hollinger who are in charge of all barn management, and Jose Landero and Malachy Young who are responsible for the supervision of research trials, protocol preparations, analysis of results and preparation of reports.

The intelligent feed delivery robotic system help to keep track of feed delivered to each pen accurately and on a daily basis. The robotic system manages multiple diets and can also blend feeds or dispense supplements or additives to specific pens with no cross contamination.

The research barn is comprised of two rooms, each with 52 pens (20.17 × 7.83 ft, total space of 158 ft^2). Temperature and ventilation for each room is automatically-controlled by one proportional environmental controller using negative pressure. Each room has the capacity to allocate up to 1050 grower-finisher pigs in 50 pens (21 pigs/pen), with two additional pens used for treated or injured pigs. The flooring is fully-slatted, pre-cast concrete slats over 1.2 m deep slurry pits. Each pen is equipped with a nose-to-nose wet/dry (Crystal Springs™) stainless steel feeder (two feeding spaces and one water nipple) and a supplementary water bowl located at the side wall of the pen. The feeder occupies a space of 2.4 ft^2, leaving an available floor space of 155.6 ft^2. Each room is equipped with an intelligent feed delivery robotic system (Feed Logic, Feed Logic Co., Willmar, MN, USA) that delivers the feed into the feeder automatically, manages multiple diets and can also blend feeds, dispense supplements or additives to specific pens with no cross contamination. The research barn has a centrally located pen scale (2.44 m × 6.10 m), two individual pig scales, office and shower facilities.

Pigs are always obtained from the same commercial farm (Lewisville Pork Farm; Irma, AB, Canada) and usually enter the research facility at 25-30 kg of body weight and leave the barn when they reach an individual market weight of 125-130 kg. Conventional daily barn management during the grower-finisher period includes daily recording of treated, sick or dead pigs, daily tracking of feed remaining in bins and feeders and verification of functioning of the feed delivery unit. The amount of feed delivered by the robotic system is recorded daily and the feed remaining at the end of each feeding phase measured manually to calculate average daily feed intake. Pigs are usually weighed at the end of each feeding phase to calculate average daily gain for each phase and for the overall period. When pigs start to reach market weight, pens of pigs are weighed every week. Carcass data (carcass weight, dressing percentage, backfat depth, loin depth and index) is collected from every pig sent to slaughter. Blood or fecal samples can be also collected for trials that require this information. Depending on the research project, feed cost per kg of gain and per pig, income over feed cost per pig and per square foot, and carcass weight produced and carcass revenue per square foot are also calculated to estimate producer profitability.

Ongoing research projects

Currently, two research projects are being conducted at the research barn to answer key questions of pork producers. In the first room, we are conducting a trial using 3, 4 and 5 different feeding phases during the grower-finisher period. Theoretically, as the number of feeding phases increase, the periods of time when the offered feed is under nutrient requirements for young pigs and over fortified for the older pig is minimized. However, if less feeding phases are used causing more instances of underfeeding, pigs seem to have the ability to compensate growth by more efficiently utilizing nutrients after a period of nutrient stress. From a practical perspective, 3 to 5 phases is usually optimal but it is important to determine if 3, 4 or 5 feeding phases gives the producer the best profitability. Therefore, the objective of the experiment currently being

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The Drumloche Research Barn has two rooms with a capacity to conduct two research trials simultaneously. Each room is serviced by six bins, each with an eight tonne capacity.

conducted in the first room is to calculate what will be the differences between these treatments (3 vs. 4, 3 vs. 5, and 4 vs. 5 feeding phases) in terms of growth performance, carcass characteristics and potential savings in feed costs.

In the second room, we are evaluating the effects of supplementing a novel phytase on feed costs, phosphorus reduction in manure, growth performance and carcass quality of grower-finisher pigs. This novel phytase has claimed to have a better efficacy than other phytases, releasing a greater portion of the phosphorus bound to phytate, calcium and energy from the diet, using less supplemental monocalcium phosphate and canola oil in the diet and therefore, reducing feed costs.

Selected published research

Feed costs are the single largest cost in pork production (65-75%) and most (70-75%) of these costs are incurred by the growing-finishing pig. Therefore, it is of interest for our company to conduct research trials focused on lowering production costs and increasing productivity during the grower-finisher period that consequently could increase the competitive advantage of Western Canadian pork producers. We have conducted several research experiments at the Drumloche Research Barn in close collaboration with universities, research institutes and private companies that share the same goal. Research conducted at this facility has already been published in scientific articles in Journal of Animal Science, Canadian Journal of Animal Science, and Journal of Swine Health and Production, among others. In this same issue of the Western Hog Journal, we are also sharing important results of a trial conducted in collaboration with Prairie Swine Centre which highlight the effects that space allowance and water availability have on pig productivity and pork producer profitability.

For more information please contact Malachy Young (malachyy@gowansfeedconsulting.ca) or Jose Landero (jose@gowansfeedconsulting.ca). ■

Each pen (20.17 × 7.83 ft, total space of 158 ft^2) is equipped with a nose to nose wet/dry stainless steel feeder and a supplementary water bowl located at the side wall of the pen.

Gowans Feed Consulting

Water availability and space allowance effects on performance and profitability

By Jose Landero[1], Denise Beaulieu,[2] and Malachy Young[1]

[1]Gowans Feed Consulting; [2]Prairie Swine Centre

Reduced floor space allowance for pigs may negatively affect growth performance as a result of competition for feed and water access, especially at later stages of the grower-finisher period. However, kilograms of pork produced per unit of floor space may increase with more pigs per pen, improving overall profitability for pork producers. We used 1008 pigs (initial body weight 32.1 kg) to evaluate the effects of 3 different space allowances (8.2, 7.4 and 6.8 ft^2 space allowance/pig, respectively) and water availability (wet/dry feeder only versus wet/dry feeder plus water bowl) on profitability, carcass traits and growth performance during the grower-finisher period. Despite an overall growth performance reduction typically observed with a higher stocking density, results from this trial clearly indicated that profitability per square foot is increased. The findings of this trial also indicated that access to an extra water source in pens stocked at higher densities and equipped with wet/dry feeders would result in a profitability improvement of the swine production unit.

Introduction

Space allowance or stocking density is expressed in terms of pigs per floor area. Space allowance is based on the body weight of the pig, which is proportional to surface area of the pig. The optimal space allowance is the minimum area per pig for maximal individual weight gain. Many experiments have arrived at the same conclusion: “a decrease in space allowance per pig reduces growth performance”, because reduced floor-space allowance increases competition for water and feed, reducing feed intake and consequently body weight gain. However, from an economic perspective it is also clear that when fewer pigs per pen are allocated in order to meet the requirement to maximize individual weight gain, less kilograms of pork are marketed over time, despite the improvement in individual weight gain.

Under conventional management practices during the grower-finisher period, pigs remain in the same pen from initial

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stocking until they reach market weight. The maximum space requirement is calculated based on the group size present in the pen until the first pig is removed for marketing. Assuming a target market weight of 125 kg, the first pigs would be typically sent to market when the average weight of pigs in the pen is around 105 to 110 kg. According to the Canadian Code of Practice for the Care and Handling of Pigs (National Farm Animal Care Council, 2014) the minimum space allowance per pig under these circumstances will be 0.75 to 0.77 m^2 or 8.04 to 8.29 ft^2. A decrease in space allowance of up to 15% is allowed by the Code in the grower-finisher period if the higher stocking density doesn't compromise the welfare of the animals.

The following experiment was designed to evaluate the effects of increasing water availability and stocking density on profitability, carcass traits and growth performance during the grower-finisher period.

The commercial-scale grower-finisher pig trial

The trial was conducted at the grow-finish Drumloche Research Barn (Lougheed, AB, Canada) using 1008 pigs. The study was conducted using a complete block design with 48 pens and 6 experimental treatments for a total of eight pen-replicates per treatment, using gender and initial pen weight as blocking criteria. Treatments were three stocking densities times two water availabilities. Each pen was equipped with a nose-to-nose wet/dry (Crystal Springs™) stainless steel feeder (2 feeding spaces and 1 water nipple) that occupied a space of 2.4 ft^2, leaving available floor area of 155.6 ft^2. Pigs were allotted to pens based on 3 different group sizes (19, 21 and 23 pigs/group) which corresponded to 8.2, 7.4 and 6.8 ft^2 or 0.76, 0.69 and 0.63 m^2 of space allowance/pig, respectively. Water availability was provided by one nipple in the trough of the wet/dry feeder (feeder only), or from the feeder plus a supplementary water bowl located at the side wall of the pen (feeder plus bowl). Pigs were fed a standard diet using four feeding phases from entry to marketing. Dietary phases were changed when the average pen weight reached the target for each phase. Feed was automatically delivered with a robotic system (Feed Logic, Feed Logic Co., Willmar, MN, USA). Pigs were weighed at each feed phase change to calculate average daily gain for each phase and for the overall period. The amount of feed delivered by the robotic system was recorded daily and the feed remaining at the end of each feeding phase was measured manually to calculate average daily feed intake (ADFI). Weight gain and feed usage were used to calculate average daily gain (ADG) and feed conversion (F:G) per phase of feeding and for the overall period. Pigs reaching the market weight (123 kg) were slaughtered and carcass characteristics data collected (carcass weight, dressing percentage, backfat depth, loin depth and index).

Feed cost per kg of gain and per pig, and income over feed cost (IOFC) per pig and per square foot were calculated for the overall trial:

Feed cost, $/kg gain = (Average feed cost per kg of feed × overall ADFI)/overall ADG.

Feed cost per pig = Feed cost per kg gain × 90 kg, where 90 kg was the average weight gain per pig for the overall period.

IOFC per pig = ((overall ADG × 108 days × Dressing % × Index % × $2.2) – (overall ADG × 108 days × Feed cost/kg gain)), where 108 days is the duration of the trial and $2.2 is the price per kg of marketed carcass.

IOFC per square foot = (IOFC × total number of shipped pigs per pen)/155.6 ft^2, where 155.6 ft^2 is the available floor space per pen.

Carcass weight produced and carcass revenue per square foot were also calculated as follows:

Carcass weight produced per square foot = (Carcass weight × total number of shipped pigs per pen)/155.6 ft^2, where 155.6 ft^2 is the available floor space per pen.

Carcass revenue per square foot = (Carcass weight produced per square foot × Index % × $2.2), where $2.2 is the price per kg of marketed carcass.

Results

Results from this trial showed that a decrease in space allowance reduced overall ADG (Figure 1) and tended to reduce overall ADFI (Figure 2) but did not affect overall F:G, which agrees with previous studies. As expected, the reduction in growth performance attributed to the reduced

CONTINUED ON PAGE 62

space allowance became more evident as the weight and size of the pigs increased (data not shown). For example, ADG was not affected during the Grower 1 (32-56 kg) feeding phase but was reduced in the pens with higher stocking densities by approximately 50 g/day during the Grower 2 (56-76 kg) feeding phase. In Grower 3 (76-99 kg), the reduction in pens with higher stocking densities was approximately 100 g/day for pigs in pens with no extra supplemental water and 50 g/day for pigs in pens with extra supplemental water. During the Finisher (99-122 kg) feeding phase, the reduction of ADG in the pens with higher stocking densities was even higher during the pre-marketing period. However, as soon as the first pigs were removed ADG was improved, especially for the pigs in the higher stocking density treatments. At this point, restriction of space was reduced and therefore no effect of space allowance was observed in the Finisher phase.

Water availability did not affect ADG during the Grower 1 to 3 feeding periods but tended to increase ADG during the Finisher feeding period, when an extra drinker was available for the pigs. If water is restricted, growth performance may be compromised as water intake influences dry matter intake. The overall reduction in ADG by 36 g/day as caused by the increased stocking density was slightly improved with the addition of a supplemental water source, with those pens showing a reduction of only 14 g/day (Figure 1).

Table 1. Effect of stocking density and water availability on carcass characteristics of grower-finisher pigs

Water availability	Feeder Only			Feeder plus Bowl		
Density (#pigs/pen)	19	21	23	19	21	23
Carcass weight, kg	97.1	95.9	96.0	96.3	97.1	96.7
Dressing percentage, %	78.7	78.8	78.8	78.7	78.7	78.9
Backfat, mm	17.0	17.6	16.6	17.1	16.9	17.1
Loin depth, mm	63.1	63.7	63.7	63.0	63.6	62.2
Lean yield, %	61.5	61.2	61.7	61.4	61.5	61.3
Index	109.7	109.8	110.6	110.3	110.5	110.3

Carcass characteristics were not affected by either stocking density or water availability (Table 1). Results from this experiment however, clearly show that profitability per square foot increases as both water availability and stocking density increase. For example, assuming that all pigs get the same standard diet per feeding phase, and an average feed cost per tonne of $210, feed cost per pig was reduced by as much as $2.30 when stocked at the highest density with an extra water source. The increase in number of pigs per pen (19 vs 23) increased the IOFC per square foot by $1.78 for pigs with supplementary water, and $2.08 for pigs with no supplementary water (Figure 4). The increase in water availability increased the IOFC per square foot by $0.67 for groups of 19 and $0.97 for groups of 23. Carcass weight produced was also increased when increasing both stocking density and water availability (Figure 5). The total carcass revenue per square foot for pigs in groups of 23 versus 19 was increased by $4.61 for pigs with no supplemental water source and $4.23 for pigs with a supplemental water source.

Conclusion

Increasing the number of pigs per pen and consequently reducing available floor space reduced ADG and ADFI in grower-finisher pigs. The addition of a supplemental water source in pens with reduced floor space resulted in a significant overall improvement in ADG and F:G. Despite the overall growth performance reduction caused by the increased stocking density, profitability per square foot increased. Profitability was further improved with the addition of a supplementary water source in the pens.

Acknowledgements

Appreciation is expressed to Drumloche Research Barn management team for their expertise and smooth running of the trial. Thanks also to Lewisville Pork Farm for the use of their animals and Sunhaven Farms Milling for supplying the feed. We would like to thank Agriculture and Agri-Food Canada through the Canadian Agricultural Adaptation Program for financial support for this trial.

For more information please contact Malachy Young (malachyy@gowansfeedconsulting.ca) or Denise Beaulieu (denise.beaulieu@usask.ca) ■

Figure 1. Effect of stocking density and water availability on average daily gain of grower-finisher pigs

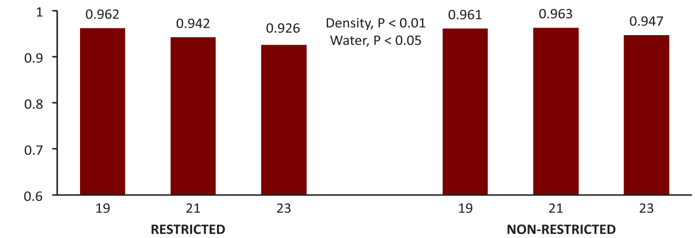


Figure 2. Effect of stocking density and water availability on average feed intake of grower-finisher pigs

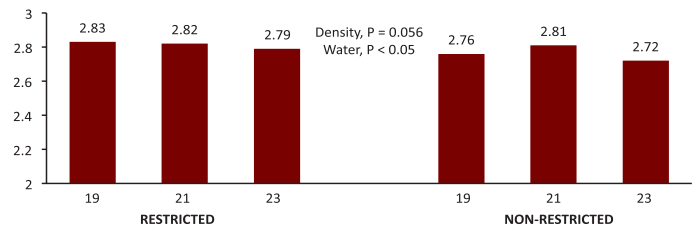


Figure 3. Effect of stocking density and water availability on feed conversion of grower-finisher pigs

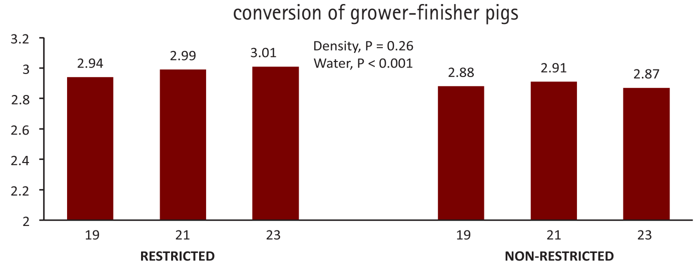


Figure 4. Effect of stocking density and water availability on income over feed cost (IOFC) per square foot of grower-finisher pigs

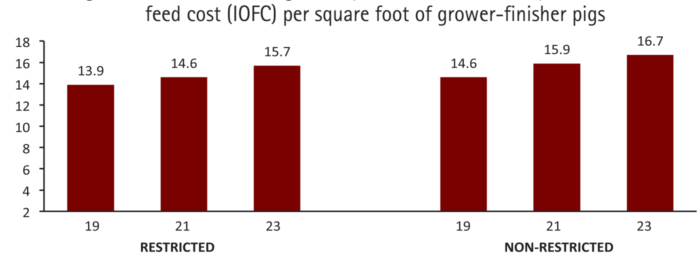


Figure 5. Effect of stocking density and water availability on carcass weight produced per square foot of grower-finisher pigs

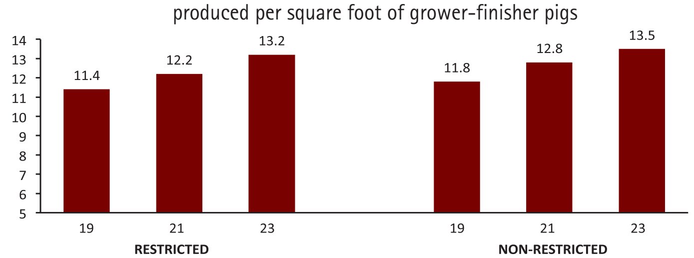
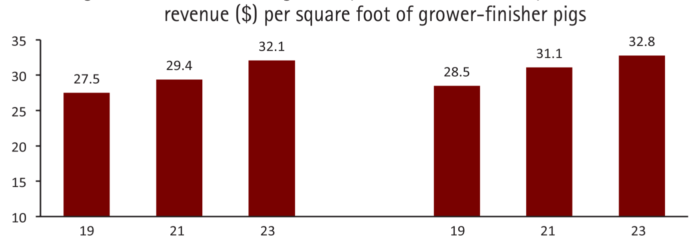


Figure 6. Effect of stocking density and water availability on total carcass revenue ($) per square foot of grower-finisher pigs



Faces and Places

Western Hog Journal

Alberta Pork Regional Meetings draw large crowds

Alberta Pork hosted its 2013 regional meetings mid-June, with staff and directors travelling throughout the province to meet with producers and industry and gather their feedback on key issues.

At meetings in Red Deer, Lethbridge, Vegreville and Grande Prairie, attendees heard the latest on traceability, the new draft Code of Practice, and the Passion for Pork campaign promoting Alberta-grown pork. They also listened to presentations from executive director Darcy Fitzgerald and chairman Frank Novak on Alberta Pork activities to support producers. One of the highlights was a presentation from Dr. Egan Brockhoff on biosecurity, and the PED virus. ■

Darcy Fitzgerald addresses the audience at the Lethbridge Alberta Pork regional meeting. Among other things, Darcy addressed how Alberta Pork works for producers and advocates for the pork industry in the province.

Dr. Egan Brockhoff uses a UV light and a substance to illustrate how easily viruses can cling to hands and other surfaces.

After shaking hands with Andy Hofer of East Raymond Colony, it's easy to see how easily something like PEDv can be transferred from person-to-person.

The Pork in the Road: How Three "Little" Pig Events Drove Pork in a New Direction

By Geoff Geddes, Alberta Pork

Once upon a time, Alberta's pork industry was in a fragile state, to say the least. An uncertain future, low prices and fallout from the grossly mislabeled "Swine flu" left producers a mere huff and a puff away from imminent collapse. But a funny thing happened on the way to impending doom – actually, several things.

Over the last few years, Alberta Pork has developed a new determination to give pork its due. This fresh perspective is bold, creative and most importantly, working.

As communications coordinator for Alberta Pork, I've had a chance to experience this transformation first hand, and it's gratifying that producers are finally getting the recognition they deserve for delivering some of the finest and safest pork in the world. Beyond that, there's a certain satisfaction in witnessing the evolution of pork from also-ran to a leader of the protein pack.

So how is it happening? They say that good things come in threes, and the flurry of activity around "June is Pork Month" was a perfect example.

Porkapa-What??

When I first heard the name "Porkapalooza", it sounded like a frat party gone horribly wrong. How was I to know that it actually referred to the biggest pork party our city has ever seen? The brain child of Alberta Pork, The Tomato and the Passion for Pork initiative, the inaugural Porkapalooza Barbeque Festival ran June 14 and 15 at Hawrelak Park in Edmonton.

The event welcomed top teams from across North America to a southern BBQ cook off for over $10,000 in prize money. In addition to cooking demonstrations by celebrity BBQ chefs, guests were treated to live music, great food and a special Father's Day Breakfast. There was also a children's play area (I didn't use it) and a lively beer garden (I might have overused it).

The R8URRACK BBQ team had a blast competing at Porkapalooza 2014.

As with any large-scale undertaking, there were a million details to iron out in the weeks leading up to the affair itself, most of them falling squarely on Alberta Pork staff and our new marketing manager Karen Gurba. But with this being the first event of its kind, the tension in those final planning hours was palpable and the air was heavy with unanswered questions... Were we really prepared to pull this off? Would the event be a success? Would people come?

Fortunately, when the barbeque smoke cleared, we were, it was, and they sure did.

Since I was also volunteering on-site at the ticket booth, I got an up close look at the inner workings of the event and the public reaction. Though I can't say it went off without a few hitches, they were minor and quickly forgotten, especially in light of the final numbers.

Given that Edmontonians were unacquainted with this concept, we were hoping for 8,000 people over the course of the weekend, and our wish was granted – on the first day. By the time the last of the pork ribs were polished off and the final flames extinguished, an astonishing 25,000+ visitors made the Porkapalooza Barbeque Festival a sizzling success, and not just in monetary terms. As the charity of choice for this non-profit occasion, the Boys and Girls Clubs Big Brothers – Big Sisters of Edmonton and Area Society raised both funding and awareness. Additionally, the Kids' Zone was managed by Adaptabilities, a charitable organization that provides goal-directed respite programs for children and adults with special needs.

Personally, it was heartening to see the community embrace this event on such a grand scale. It was a much needed boost for producers, worthy causes and our industry as a whole, and it was a big step in establishing Alberta-grown pork as the tastiest, healthiest and most versatile meat on the market. What more can you ask for?

Pig and Pinot

Three days later we switched gears and became the centre of the plate again at the world class culinary event, the fourth annual Pig and Pinot Festival held at the Hotel Arts in Calgary. Thirteen local restaurants and caterers served 350 guests some outstanding pork dishes, while the city's best wine shops poured a global selection of red and white pinots. It was a chance to experience exceptional pork and pinot pairings while raising funds for Calgary Meals on Wheels.

Baconfest

With pork on a roll, why slow it down? Alberta Pork helped sponsor the first ever Baconfest on July 4. Even many of those who don't eat pork on a regular basis (and apparently there are a few) seem to love bacon, so this was a chance to indulge that passion in a major way. Attendees enjoyed a vast array of bacon creations from Edmonton's top chefs and sampled some of the finest bacon cocktails ever made.

Along the way, there was music, dancing, comedy and a chance to meet Edmonton's official Bacon Meister. With our city's festival season in full swing, the timing couldn't have been better. And coming on the heels of Porkapalooza, it was a great opportunity to maintain the momentum and keep pork where it belongs – in the spotlight.

Crowds lined up to watch the barbecue teams hard at work, as well as for the chance to sample some of the Porkapalooza tastes.

BBQ on the Bow

When it comes to celebrating all things pork, forget about the Edmonton-Calgary rivalry. Food this good was meant to be shared.

BBQ on the Bow is an annual barbeque event that runs August 29-31 at Calgary's Eau Claire Festival Market. Billed as Canada's oldest barbeque competition, this free spectacle started in 1993 and is more popular than ever. Teams vie for recognition as the Grand Champion by earning the most points in all four required categories – Chicken, Pork Ribs, Pork Butt (shoulder) and Beef Brisket.

While it's a lot of fun for everyone, it's also serious business for the teams. Competition is fierce, with many participants staying up through the night to tend the fire and baste the meat. Personally, it would take something extraordinary for me to pull an all-nighter. But then, as I've come to realize, pork is no ordinary meat.

So far this summer, that makes three weeks, three events and three chances to showcase the finest pork around, with BBQ on the Bow still ahead. Maybe it's true that good things come in threes. But it's only just begun! If you enjoyed the action thus far, you'll love the fall festivities, including an invitation to "come home to Alberta pork" this Christmas.

Suddenly pork is everywhere. In what feels like the blink of an eye, it's gone from a bottomless pit of red ink for producers to being "the new black". And if it's also true that good things come to those who wait, I'm dying to see what next year has in store. Aren't you? ■

YOUR DAILY BACON

BY BUDDY SIMMONS

We all know how to eat bacon – in quantity and with great reverence, that hasn't changed since somebody said, "Hey! Let's try THIS part of the pig!" – but we now have more choices regarding how to prepare the tasty meat. Gone are the days of merely being able to slap the strips into a cast-iron skillet and frying it until it reaches the desirable crispness. We now have a variety of methods! So in this installment of "Your Daily Bacon," we will show you a couple of the relatively new-fangled methods. Note that Your Daily Bacon is not endorsing these gadgets, we just thought it would be fun to show you a couple of them. One of the featured tools is actually available, but the other sadly seems to have been relegated to the "Why the heck can't I buy this?!" department.

Microwave bacon cooking tools are by now nearly as old-hat as the cast iron skillet. But here is an innovation that is fairly recent – the Perfect Bacon Bowl. With this thing, you are supposed to be able to lattice your strips of bacon over the concave oven/microwave-safe dome and cook for the prescribed amount of time. When it is finished cooking, you should have a nice bowl-shaped helping of bacon in which you can serve the food of your choice. After finishing those contents of the bacon-bowl, you can eat the bowl. The manufacturers suggest filling your bowl with things like macaroni and cheese, lettuce and tomato, a burger and even ice cream. Naturally, we suggest filling the bacon bowl with more bacon, but we like the way they think.

Sadly, reviews of the efficacy of this product have been a bit mixed and although it could be attributed to user error, some of the reports we have seen indicate that the bowl does better making bread bowls than bacon ones. Boo! The issue seems to be that the finished bacon bowl is fragile and tends to crack or even crumble. But hey – bacon bits are great too! Or you can just use the tried-and-true method of making bacon-bowls by putting the bacon strips over an upside-down muffin pan. Far be it from us to dictate which bacon-bowl-creating gadget to use, but we should point out you only get at most four of the bacon-bowls for your cash, whereas you can make at least six at a time with a muffin pan. That's a bonus right there!

Now, it is with a heavy heart that we must announce that this next one doesn't seem to have moved past the prototype stage, but since we think it was a work of sheer genius, we are including it anyway. What is the only negative side of having bacon for breakfast? Having gone a full night without it, and then still having to cook it, of course. But if this invention ever sees the light of day, bacon fans will rejoice! It is called the "Wake 'n Bacon". It is an alarm clock, but much, much more. This marvel of technology prepares your bacon while you sleep! You simply place some frozen bacon in the handy tray and set the clock for the time you wish to rise. It begins to cook the bacon 10 minutes before your alarm goes off so that you truly will have a reason to get out of bed in the morning.

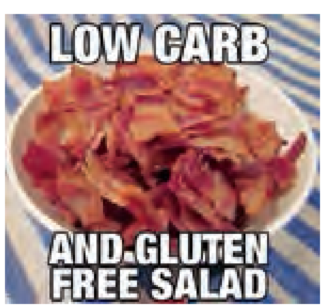
Unfortunately, it appears to only prepare a piece of bacon at a time, but that should be enough to keep you going until you can fry up an entire slab. But alas, it seems that it was not to be. We diligently searched for a place to buy it and came up bacon-less. (By "diligently searched", we mean we looked online for 10 minutes or so. We figured that if you can't locate something on Google or Amazon, it doesn't exist and gave up on trying to locate it.)

We can only presume that either it was a cruel joke or the risks of sleeping while a cooking object sits next to your bed outweighed the benefits. If it was the former, bacon is nothing to joke about and if it was the latter... well somebody in a marketing research group severely underestimated our dedication to procuring freshly cooked bacon with the minimum of fuss. Maybe more consideration should have been given to the cabinet; wood does not strike us as the optimal material for such an appliance. However, we are keeping our fingers crossed that somebody will pick this idea up and run with it. All that would be needed would be a built in smoke alarm and fire extinguisher. Sure, that would send the cost of the device skyrocketing, but can you really put a price on a good piece of bacon? We didn't think so.

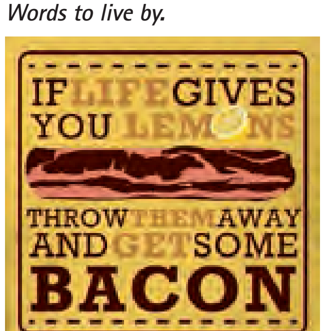
So as to not to leave on such a disappointing note, check out this issue's featured bacon memes! ■

What a REAL Bacon-Cheeseburger should look like!

Sounds like the healthy choice to us!



Words to live by.



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