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Benchmarking – The Right Tool For The Times

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"Benchmarking" is commonly spoken of but rarely implemented in pork production. The term "benchmark' can be traced to land surveyors, who erected "benchmarks" on high ground that could then be used as references for mapping the terrain. A "benchmark" is in the truest definition a point of comparison. In business literature the creation of formalized benchmarking is often attributed to Rank Xerox Corporation, in fact the practice dates back to ancient times. Japan sent teams to China in 607AD to learn best practice for business, government and education. In pork production we have regularly posted benchmarks for productivity such as top indexing herd in the county, or reproduction awards like the one presented at Banff to Kyle Colony in Saskatchewan with over 30 pigs weaned per mated female. These are a tremendous accomplishment and a reminder of how our industry has ramped up productivity consistently over the past quarter century.

All too often however the complexity of benchmarking cost of production, the next natural step in comparing production units, does not receive the same attention as productivity. There is good reason for this since the age of assets, debt load, labour costs and accounting practices make comparisons difficult if not impossible. That however shouldn't dissuade us from trying to benchmark cost of production, because the power of having that information is indeed worth the effort.

(Benchmarking ... continued on page 10)

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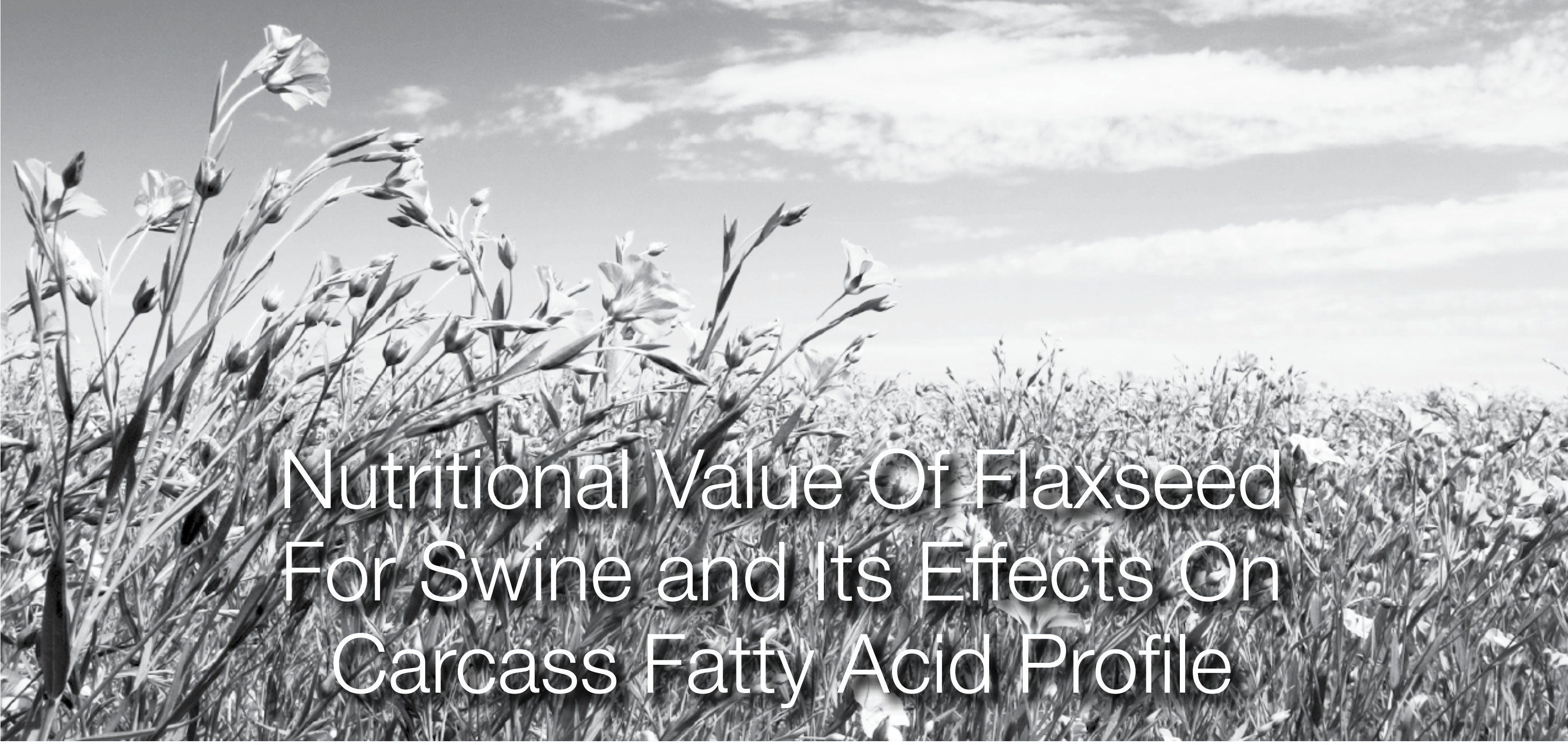

Nutritional Value Of Flaxseed For Swine and Its Effects On Carcass Fatty Acid Profile


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Canada, or more specifically Western Canada, is the largest producer of flaxseed in the world, producing over 0.9 million tonnes last year. Almost 75 % of the crop will be exported, more than 60 % going to Belgium. Flaxseed possesses properties which make it unique as a feed ingredient for swine. One of its nutritional attributes is, of course, the oil (also called linseed oil) which is rich in omega-3 fatty acids. Flaxseed contains 41% oil and the oil contains 57 % omega-3 fatty acids (primarily alpha linolenic acid or ALA) making it the richest plant-based source of ALA.

Prairie Swine Centre, in collaboration with Agriculture and Agri-Food Canada, Lacombe Research Centre, the University of Alberta and the University of Saskatchewan, has conducted a series of experiments examining the use of flaxseed as an ingredient in swine diets. The overall objective of these series of experiments was to develop low-cost feeding protocols which will result in a consistent enrichment of the carcass with ALA without compromising growth or carcass quality.

The first step was to obtain a well-defined nutrient profile of these ingredients, including DE, NE, fatty acid and amino acid digestibility and growth performance. Initial data was also obtained on ALA enrichment of the carcass. This report describes the results from these experiments. Subsequent issues of COS will provide more detailed information on the ALA enrichment of the carcass and effects on carcass and pork quality.

Table 1: Comparison of flaxseed, solvent extracted FSM, press extracted high fat FSM and the co-extruded flaxseed:field pea product (LinPro®) used in these studies (% DM)

	Flaxseed	Solvent Extracted FSM (NRC, 1998)	Press Extracted High Fat FSM (experimental)	LinPro
Crude Protein	25	37	34	24
Ether Extract	37	2	13	21
NDF	25	27	25	20
ADF	15	17	16	12
Calcium	0.25	0.4	N/A	0.2
Phosphorus	0.6	0.9	0.9	0.5
Lysine	0.97	1.38	1.39	1.14
Methionine	0.37	0.67	0.65	NA

Flaxseed Products

We incorporated the flaxseed into the diet using either LinPro®, an extruded flaxseed: pea product produced at Oleet Processing Ltd, Regina, SK, or by using flaxseed meal (FSM). The FSM we used was actually imported from Belgium, (therefore a round trip for this oil!). The Belgium company (Vandeputte S.A.) is seeking export opportunities for this by-product, moreover, demonstration of the benefits of this FSM could assist with the development of a local crushing industry. As a by-product FSM should be less-costly than the full-fat seed, and in European markets is comparable to the cost of soybean meal. The FSM used in these experiments had been produced without a solvent-extraction step, and the meal contains up to 13% oil, therefore it is both a protein and a fat source and can be used

Table 2: Digestibility values and energy content of FSM for growing pigs and gestating sows

	Growing Pigs	Gestating Sows
Digestibility (%)		
Dry Matter	63	65
Ether Extract	59	45
Gross Energy	62	68
Digestible Energy		
(Mcal/kg DM)	3.51	3.54
Net Energy		
(Mcal/kg DM)	2.43	2.44

Table 3: Apparent ileal digestibility and content of amino acids in FSM (DM basis)[1]

Nutrient	AID, % [1]	AID, g/kg[1]
Arginine	86.1	28.2
Histidine	67.3	5.0
Isoleucine	73.6	10.8
Leucine	71.3	14.8
Lysine	61.7	8.6
Methionine	75.3	4.9
Phenylalanine	78.4	12.9
Threonine	58.9	7.5
Tryptophan	25.1	1.0
Valine	71.2	12.3
CP	61.4	222.5

[1]Determined in 40 kg barrows. Data from Htoo et al. 2008. JAS 86:2942-2951.

as a product to enrich the carcass with ALA. A comparison of flaxseed, solvent extracted FSM, high fat FSM and LinPro is shown in Table 1. As expected the amino acid content of flaxseed is less than FSM, due to the dilution with the oil. The lysine contribution from the field peas is reflected in the LinPro.

Experimental Procedure

Flaxseed meal

Two hundred growing pigs (initial weight, 32 ± 4 kg) were used to determine the effects of the FSM inclusion on pig performance. The diets contained 0, 5, 10 or 15 % flaxseed and were phase fed to meet nutrient requirements of the growing pig. Diets were balanced for NE and digestible AA content. At the time of market, 6 pigs per treatment group (total of 24 pigs) were randomly selected from different experimental pens and both backfat (inner and outer layers) and rib-end loin samples (longissimus dorsi) were collected at the slaughterhouse for fatty acid analysis.

Total tract apparent nutrient digestibility was determined in growing barrows, and gestating sows. Standardized ileal amino acid digestibility was determined in growing barrows.

Results

The digestibility values for dry matter, ether extract and gross energy as well as the DE and NE content of FSM are shown in Table 2. Similarly the ileal amino acid digestibilities of FSM are shown in Table 3. Digestibility coefficients were similar in growing pigs and gestating sows, indicating minimal hindgut fermentation or absorption of the nutrients in the FSM. Despite the high oil content, the DE content of the FSM is comparable to soybean meal however, it contains approximately 25 % more NE than SBM. Digestibility of overall DM and most of the AA was lower than is usually observed with oilseeds.

The effects of FSM inclusion on growth performance and carcass fatty acid profiles are shown in Table 4. Average daily gains, ADFI or G:F were not affected by any level of FSM inclusion ($P > 0.05$). Increasing levels of FSM lead to a linear reduction in saturated fatty acid content (palmitic and stearic acids) in the backfat of the pigs ($P < 0.01$) while linearly increasing the ALA content of both backfat and loin samples ($P < 0.001$). Inclusion of 15% FSM lead to an increase in the ALA content from 11 to 47 mg/g backfat tissue and from 5 to 10 mg/g loin tissue.

LinPro

LinPro is an extruded 50:50 field pea:flaxseed product. Initial experiments at the University of Saskatchewan and the Swine Research and Technology Centre at the University of Alberta determined the optimal extrusion conditions to maximize energy, lipid, fatty acid, and amino acid digestibility (Htoo et al. 2008).

Subsequently, the Prairie Swine Centre and Lacombe Research Centre, using the optimally extruded product, conducted a series of experiments designed to provide information which would enable producers to develop feeding programs to efficiently and consistently enrich pork products with ALA without detrimental effects on pork quality. Results reported here are from an experiment designed to determine optimal inclusion rate and length of feeding.

LinPro was included at either 10, 20, or 30 % (5, 10, 15 %) into a wheat, barley, soybean meal based diet and fed for 4, 8 or 12 weeks prior to market. Diets were formulated to be equal in energy and amino acid content. The content of field peas was the same in all diets.

Table 4: ADG, ADFI, and the fatty acid content of backfat and loins of pigs fed with graded levels of FSM

	Flaxseed meal in diets, %					P values	
	0	5	10	15	SEM	Linear	Quadratic
ADG, kg/d	0.95	0.94	0.91	0.92	0.02	0.14	0.41
ADFI, kg/d	2.66	2.65	2.79	2.67	6.5	0.55	0.42
G:F	0.36	0.36	0.33	0.35	0.01	0.25	0.34
ALA, mg/g wet tissue							
Backfat	11.1	21.7	34.4	47.4	0.8	< 0.001	0.13
Loin	5.0	6.4	9.3	10.1	0.4	< 0.001	0.48

Results

The handling properties of the extruded flaxseed:pea product were superior to full-flax flaxseed. The blend flowed readily through the grinding equipment. Careful control of extrusion conditions were required to obtain an optimal product based on improving amino acid, energy and fat digestibility. Another potential benefit from the heat used in the extrusion, but not examined in these studies, is the inactivation of antinutritional factors in the field peas.

Relative to an unextruded 50:50 flaxseed:field pea blend, extruding increased DE content from 3.70 to 4.35 Mcal/kg or greater than 17% (Table 5). Dry matter and crude protein digestibility were

(Nutritional Value ... continued on page 5

Whittington Honoured For Industry Leadership

On March 17, the Alberta Pork Congress recognized its annual list of people who are making a difference in the Alberta pork industry. This year Sam Harbison received the Lifetime Achievement Award, Peace Pork Farms Ltd. employees and management received the Farm Team Award, and Lee Whittington the Industry Leadership Award.

The Alberta Pork Congress Industry Leadership Award has been presented annually since 1979. This award "honours individuals whose efforts reflect a commitment above and beyond the accepted expectation of the pork industry in Alberta. It recognizes individuals whose actions have become a valuable asset to the pork industry and acknowledges those whose actions have become models for peer recognition".

Mr. Whittington has served the pork industry in many roles including his first position in sales and service in the Ontario feed industry following graduation from University of Guelph. During his 13 years with Shur Gain Feeds, Mr. Whittington served in many roles including nutritionist, and leading the swine technical sales group. In 1992 Lee was recruited to be part of the team to start the Prairie Swine Centre, he reflects on that period, "At the time there was an incredible amount of optimism in the North American pork industry and the opportunity to start something new, a concept that combined the best parts of research endeavour with business and supported by the pork industry provided a focus and energy that was invigorating."

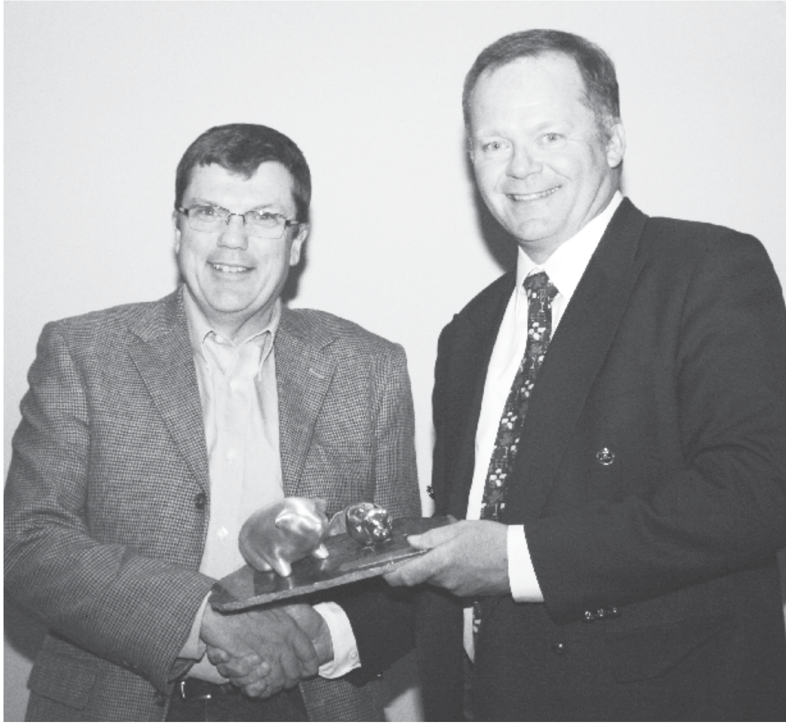
18 years later the Centre has become synonymous with practical advances in pork production science, and that unique industry partnership has remained at the heart of why Prairie Swine Centre personnel do what they do. Mr. Whittington summed it up in his acceptance speech

"Of course the honour goes to our production staff who work with our technicians to impose change every day on our production system (such as no cross-fostering for next two months, or wiring bundles of new sensors throughout the room).

The honour goes to the graduate students and research scientists who seek to understand industry challenges and opportunities and see solutions not just problems.

The honour goes to our accounting and finance personnel that keep over 40+ granting agencies, associations and corporations accurately informed of how their monies are spent.

It is because of those people and the dedicated leadership of our voluntary board of directors that we have been able to bring you new information to improve the bottom line, reduce the impact on the environment, provide insights into animal management and well-being, and contribute to a safe workplace for families and staff."



Lee Whittington (right) receives Award from Elanco representative Bob Hehr

> "Prairie Swine Centre exists because of, and for as long as, the pork industry sees value in their investment in research."

Prairie Swine Centre exists because of, and for as long as, the pork industry sees value in their investment in research.

The Centre has contributed to our industry's knowledge in the areas of nutrition, engineering, behaviour, management and production economics. This knowledge, and this success has come about by many people focusing on what is important to the industry and day in and day out weighing tonnes of feed and thousands of pigs; SUCCESS IS NOT NECESSARILY DOING EXTRORDINARY THINGS, BUT DOING ORDINARY THINGS EXTRODINARILY WELL.

"If we have given you better data to make decisions, provided tips to reduce costs or helped you realize some new opportunities to improve net income then we have achieved what we set out to do."

(Nutritional Value ... continued from page 3)

Table 5. Apparent total tract or ileal digestibility of nutrients in coextruded 50:50 flaxseed peas

Item	Control[1]	Extruded
Digestibility, %		
Dry matter	75.0	80.5
Crude protein	79.2	77.3
Gross energy	69.6	80.6
Total fatty acids	70.1	87.2
C18:3 (ALA)	74.1	90.3
Ileal digestibility, %		
Lysine	69.2	84.9
Threonine	64.4	72.7
Leucine	58.9	79.3
Phenylalanine	66.6	82.6
Available lysine, %	0.94	0.97
DE, Mcal/kg	3.70	4.35

[1]*Ground but not extruded.*

also improved. The apparent ileal digestibility of all the essential amino acids were improved by extrusion (not all are shown), the extent of this improvement varied from 2 to greater than 35 %. This is important because heat processing can damage AA availability, especially lysine. Although determining apparent ileal digestibility does not always determine the availability of the amino acid, a further analysis showed that the content of available lysine was unaffected by the extrusion conditions chosen. The results of the digestibility trial are shown in Table 5.

Similarly, regardless of degree of saturation or chain length, extrusion consistently improved digestibility of the fatty acids. Notably, the digestibility of C18:3 (ALA) increased from 74 to 90 % or by greater than 20 % in the extruded product.

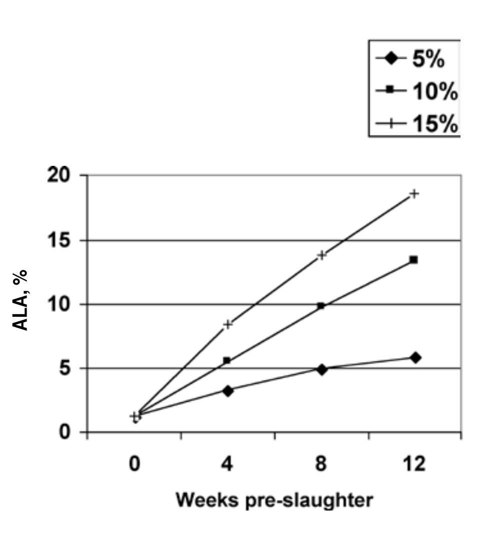


Figure 1. The effect of feeding 5, 10 or 15 % co-extruded flaxseed (10. 20 30 % LinPro) for 4, 8 or 12 weeks preslaughter on the ALA content of backfat.

Using the extruded product, flaxseed level in the diet had no effect on growth performance (Table 6), however, feeding the flaxseed for 12 weeks decreased overall gain by about 400 g/day, when averaged over all flaxseed incorporation levels. Feed intake decreased with increasing flaxseed in the diet, and thus there was slight improvement in feed efficiency. There was a linear improvement in the omega-3 (primarily ALA) content of backfat with increasing flaxseed in the diet and length of feeding period prior to slaughter. The greatest enrichment, therefore, was observed with 15% flaxseed fed for 12 weeks (Figure 1).

The Bottom Line

FSM (containing 13 % oil on a DM basis) is a novel protein source that can be incorporated into swine diets. With the exception of its characteristic, low lysine content, the CP fraction of FSM is comparable to that of canola meal in terms of both quantity and quality. Flaxseed meal also contains higher DE and NE values compared to canola meal, thus, making it an attractive alternative to other common protein sources. When diets are properly balanced to meet both the NE and digestible AA requirements of the pigs, FSM can be included into diets without adverse effects on performance while yielding a carcass enriched with ALA.

LinPro, when extruded under optimal conditions, is a good source of energy, omega-3 fatty acids and lysine for swine. Feeding up to 15% LinPro for 8 weeks had no impact on animal performance. The addition of LinPro to the diet provided a highly available source of omega-3 fatty acids, yielding ALA enrichments in backfat which are comparable to diet supplementation with flaxseed (linseed) oil. Feeding higher levels of LinPro for shorter periods versus lower levels for longer periods was more efficient at increasing omega-3 fatty acids in backfat.

Acknowledgements

This project would not have been possible without the funding support provided by Vandeputte S.A. (Mouscron, Belgium) and Flax Canada. 2015. FSM and Linpro was generously donated by Vandeputte and O & T Farms, respectively. The authors also acknowledge the strategic program funding to the Centre provided by Saskatchewan Pork, Alberta Pork, Manitoba Pork Council, and Saskatchewan Agriculture and Food Development Fund.

Table 6. Performance of grower-finisher pigs fed different levels of co-extruded flaxseed for 4, 8 or 12 weeks prior to slaughter.

	Control	% flaxseed in diet[1]			Weeks			SEM	P value	
		5	10	15	4	8	12		Diet	Weeks
Initial weight, kg	31.1	30.8	30.9	31.4	30.9	31.2	31.0	1.48	0.31	0.74
Final weight, kg	109.7	114.6	112.9	115.2	115.6	115.7	111.4	2.09	0.36	0.02
ADG, kg/d	0.94	1.00	0.98	1.00	1.01	1.01	0.96	0.01	0.42	0.02
ADFI, kg/d	2.46	2.60	2.50	2.47	2.58	2.55	2.45	0.03	0.01	0.06
Feed efficiency (G:F)	0.38	0.39	0.30	0.41	0.39	0.40	0.39	0.01	0.01	0.80

[1]Equivalent to 10, 20 and 30% LinPro.

Comparative Evaluation Of Infrared Radiant and Forced-air Convection Heating Systems For Hog Barns

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The overall goal of this study was to compare a gas-fired infrared radiant heating system with a conventional forced-air convection heater for supplying supplemental heat to pig production rooms. Forced-convection air heaters that are widely used in commercial barns typically heat the air near the ceiling, and in turn the heated air has to be physically moved, using fans and inlets, to the animal occupied zones. A radiant heater transmits heat to surfaces (i.e. floor, pen wall, animals, etc) through radiation heat transfer, thus facilitating the heating process at the pig's level and at the same time the heated surfaces serve as a thermal reservoir that help maintain the setpoint conditions in the room. Because of this difference in mode of heat transfer, it is hypothesized that infra-red radiant heating could help reduce heating costs in pig production rooms.

Experimental approach

The two heating systems (forced-convection vs. radiant heating) were compared for energy efficiency and impact on indoor air quality and hog performance. The comparative evaluation will be conducted over three trials, two of which are already completed. The study will cover the seasonal variation in ambient environmental conditions throughout the year.

Two grow-finish rooms at PSCI research facility were used; one room had a 80,000 BTUh forced-air heater (Control) while a 80,000 BTUh gas-fired infrared radiant heater (Treatment) was installed in the other room (shown in Figure 1). Both heater units were brand new when installed. Each room has inside dimensions of 66 x 24 x 10 ft and has 20 pens that could accommodate 5 pigs per pen, each pig averaging between 25-30 kg starting weight. The rooms were identical in terms of building construction, pen configuration, animal capacity, and care and management.

Various monitoring instruments were set up in each room to assess the performance of the two heater types. A gas meter equipped with a pulser was installed in each room to monitor gas consumption. Energy loggers were also used to record electrical energy consumption of ventilation fans, lights, and heater blower motor. Sensors used to monitor air temperature and relative humidity, ventilation rate and gas concentrations were also deployed in the room. In addition, performance indicators for the pigs were recorded throughout each trial.

Results from completed trials

Gas and electrical energy consumption

The first trial was started in late spring in 2008, during which the ambient conditions became warm enough that the infrared radiant heater was needed only for the first 2 weeks while the forced-air heater ran intermittently only for the first 3 weeks. Gas consumption by the radiant heater was slightly higher in the first week but lower in the following 2 weeks than the forced-air heater. Trial 2 was started in early winter and the gas consumption of both heaters is shown in Figure 2. It can be observed that both heaters were barely

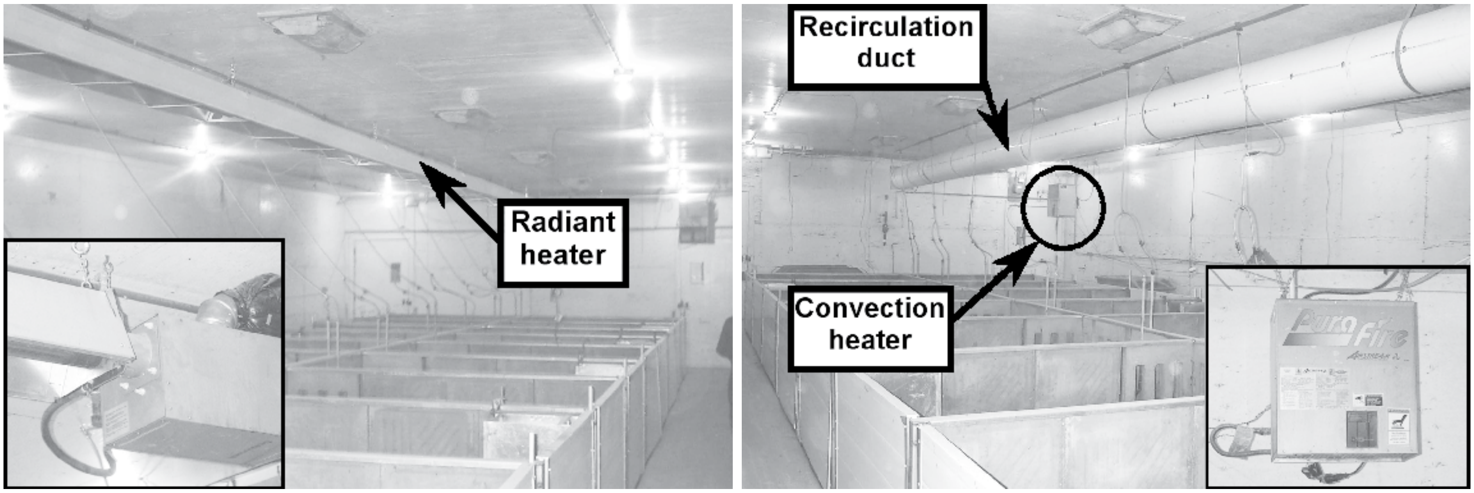

Figure 1. Photo of the experimental rooms. A: Treatment room with a 50-ft long infrared radiant heater (inset- heater part); B: Conventional production room with a forced-air convection heater (inset).

in operation after Week 7, which was expected since the setpoint room temperature at this stage of growth is lower and the pigs are large enough to generate adequate heat to meet the setpoint. However, for the weeks of the trial when both heaters were operating, the infrared radiant heater consumed 98 m3 gas more than the forced-air heater.

The average amount of electrical energy consumed (Trial 1 and 2) in both the infrared radiant heater and forced-air heater rooms is shown in Figure 3. Throughout the 12-week test period, electrical consumption was relatively similar in both rooms. However, total electricity use was 205 kWh higher in the Control room than the Treatment room. This could be attributed to the additional electrical energy consumed by the recirculation fan in the Control room. It should be noted that the recirculation fan is part of the heating and ventilation system necessary to distribute heat more uniformly throughout the Control room; no recirculation fan was required for the Treatment room.

Indoor air quality

Air quality parameters monitored within each room include air temperature, relative humidity, ventilation rate and gas concentrations. Figure 4 shows the average temperature readings at the different locations within the Control and Treatment rooms during the first 3 weeks of each trial when both heaters were in operation. It can be observed that temperatures near the middle of the room were slightly higher than those at the peripheral locations of the room, especially near the exhaust fan. This slight temperature variation could be due to heat loss through the outside wall where the exhaust fans were installed. A comparison between the first and second trials

(Comparative evaluation ... continued on page 11)

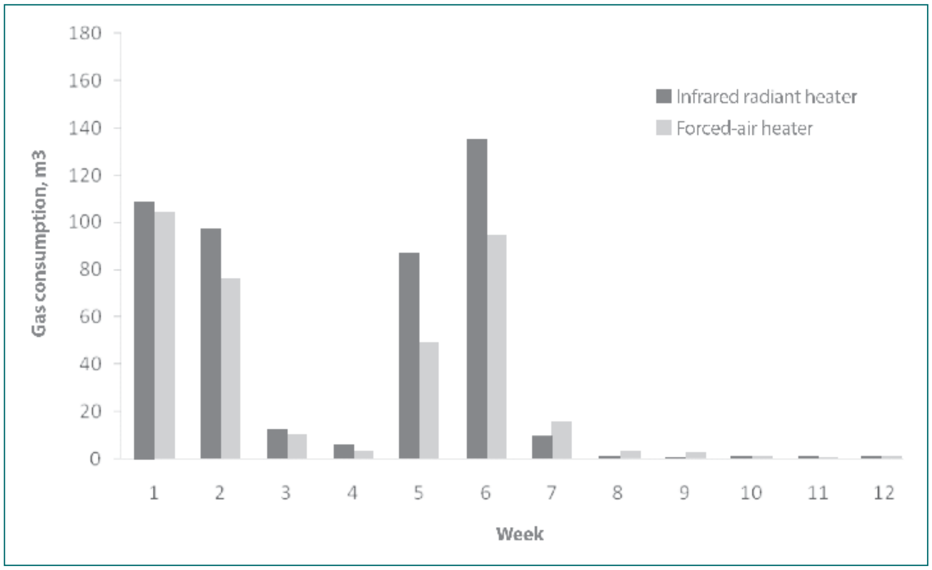

Figure 2. Gas consumption of infrared radiant heater and forced-air convection heater in Trial 2.

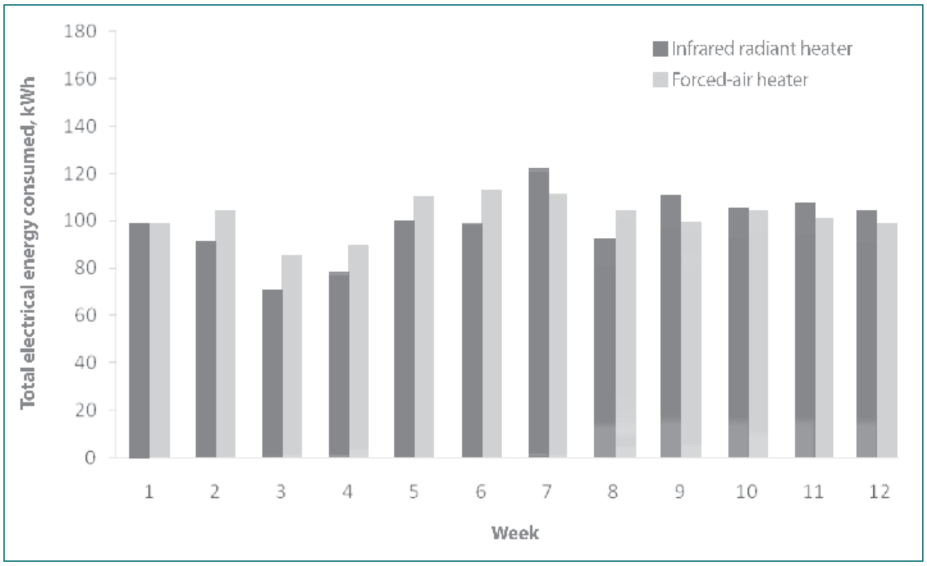

Figure 3. Total electrical energy consumption in the rooms with forced-air convection heater and with infrared radiant heater.

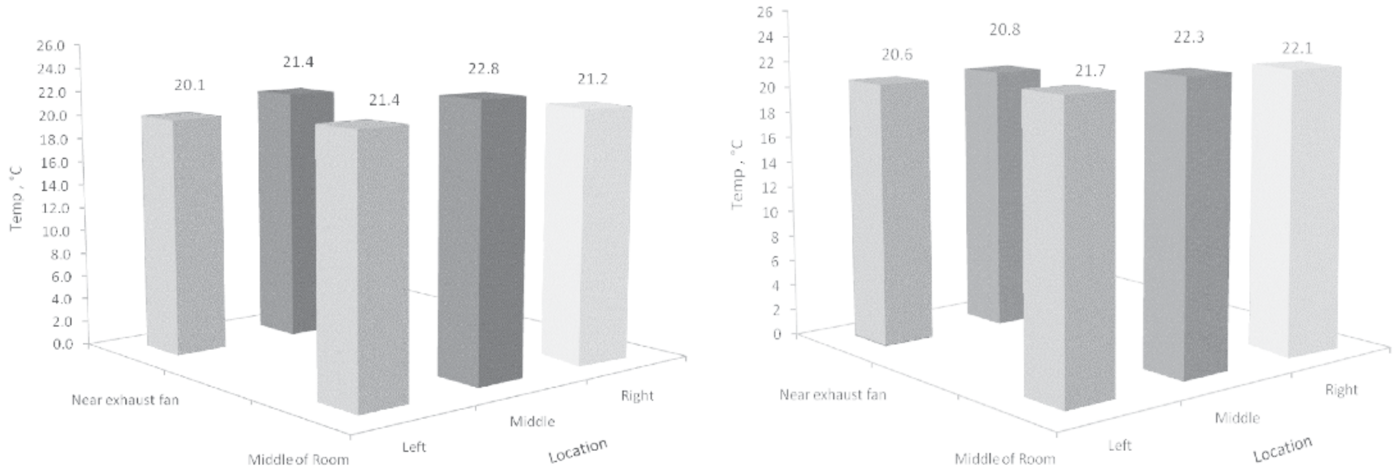

Figure 4. Average temperature distribution within the Treatment (A) and Control (B) rooms during the first 3 weeks of the test period.

Free space utilization of sows in free access stalls

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With announcements by the largest producer/packers in both the USA and Canada that they will transition all of their production facilities to group housing for sows over the next ten years, all North American producers are anticipating a change to group housing. This can be a challenging step for producers, and it is made more difficult by the lack of scientific information currently available on the implementation and design of alternative systems. Group housing systems can be complex to initiate and require greater input from stockmen, however when done correctly, can produce sows that are able to socially interact with one another and have the freedom to move. Sows currently housed in gestation stalls have almost no opportunity to exercise and perform natural behaviours, leading to a possible decline in well-being. It has previously been suggested that exercise is required to maintain bone composition and strength, and when exercise is insufficient, calcium will be mobilized from the bone itself (Lanyon, 1984 and 1987). Exercise is important to allow the development of bone and muscle to their maximum potential. Decreased muscular strength (which is commonly observed in confined sows) can contribute towards difficulty in lying and standing, and higher susceptibility to lameness due to increased slipping. Lack of exercise in confined housing has also been shown to cause bone weakness in other species. For example, confined laying hens have significantly weaker humeri and tibiae than birds housed in non restrictive environments (Knowles and Broom, 1990). One possible alternative to gestation crates are free access or walk-in/lock-in stalls. This system provides sows with opportunities to interact as a group in a communal area, or remain alone in a free access stall. There is some concern regarding the degree to which sows use free space group areas, and how to avoid aggression, particularly when new sows are mixed into a group. This study investigates the implementation of walk-in/lock-in stalls for group housed sows. More specifically, the objectives of this study were to compare two different pen configurations by determining the proportion and type (size/parity) of sows that are using the free space areas of the walk-in/lock-in stalls, and also how sows utilize the free space areas.

Looking down onto the 'I' pen

Pigs using the 'T' pen free space area

Eight groups of ~25 sows were used in the study, and were housed in walk-in/lock-in stall gestation pens at the Prairie Swine Centre, Saskatoon. Groups were selected according to how many individuals were confirmed pregnant in a batch of animals within a 2 week breeding date window, therefore group size was not always the same. Each of the groups were exposed to one of two configurations of free space areas. The first is referred to as the 'I' pen as it consisted of an alley (10ft x 35ft) with slatted flooring running between two lanes of 16 stalls on each side. Any additional stalls, surplus to the group number, were locked off for the purpose of the trial. The second pen configuration is referred to as the 'T' pen as it consisted of an identical alley with an additional solid floor loafing area at one end (12ft x 23ft). Sows were weighed when moved from their breeding stall to the gestation pen, and individually marked with livestock paint.

Photographs were taken from mounted cameras at 2 minute intervals over a 24hr period, once a week, for 11 weeks throughout gestation. Two cameras were set up in the 'I' pen, one at each end of the pen. Four cameras were used in the 'T' pen in order to also observe the free space area. The pens were divided into 3 areas (I pen) and 9 areas (T pen) (see Fig. 1). The individual sow and location was recorded numerically by a trained observer. Measurements recorded from the photographs include the percentage of time spent out of the stall over 24hrs, and also the

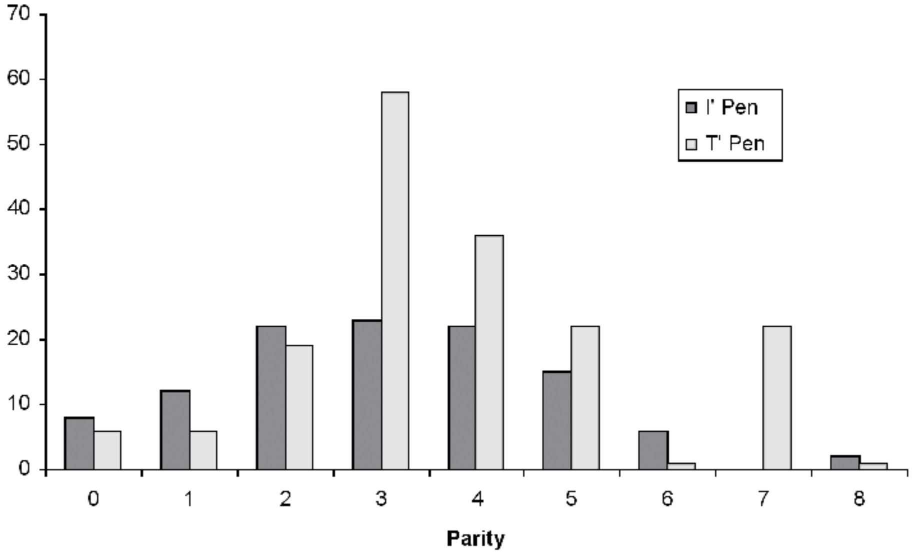

Figure 2. Average total time that sows of varying parities spend in the free access areas.

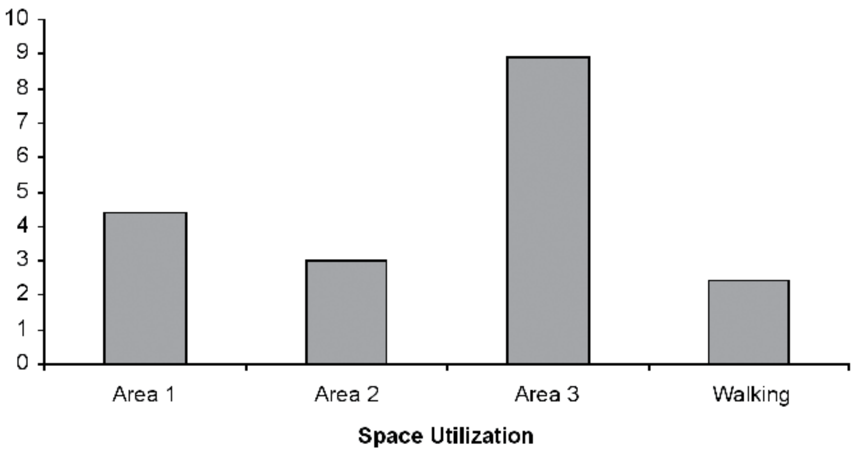

Figure 3. Percentage of time that sows spend in each location during utilization of the free space areas, I-pen data.

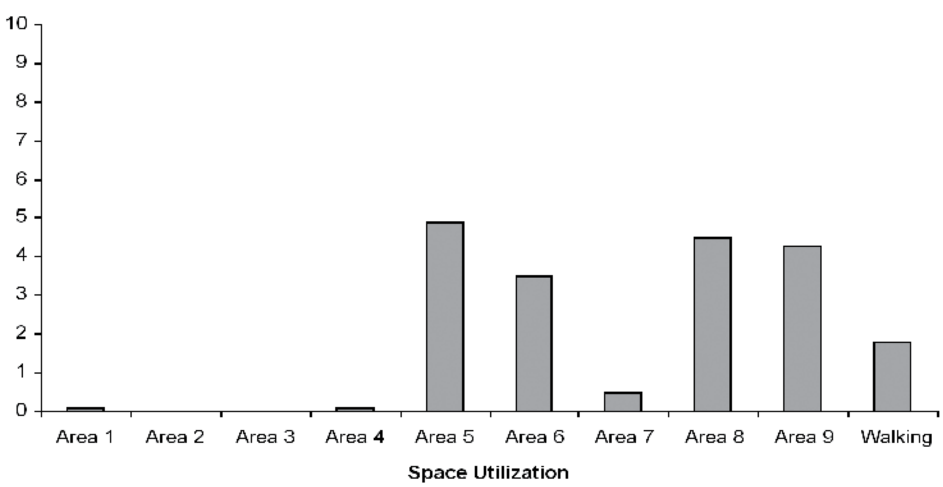

Figure 4. Percentage of time that sows spend in each location during utilization of the free space areas, T-pen data.

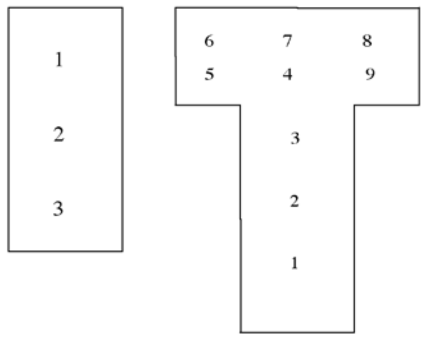

Figure 1. Location of free space areas used for space utilization analysis.

location and position of sows in the free space areas.

The majority of sows did use the free space areas (> 95% of sows) although not on a regular basis or for extended periods of time. The average usage for the 'I' and 'T' pens were both relatively low, however, the sows housed in the 'T' pens used the free space area significantly more than the sows housed in the 'I' pens (P<0.001). More than half the animals in the study spent < 5% of their time in the free space area, however the average usage was ~18% (with considerable individual variation). Heavier sows appeared to use the free space area significantly more than lighter sows (P<0.0001), and older (higher parity) sows also used the free space significantly more (P<0.001) (Fig. 2). Figures 3 and 4 illustrate the preferred lying areas of the sows. In the 'I' pens, the far end of the pens was the most preferred place to lie, with the highest recorded usage in Area 3 with 8.9% of the average total usage. Similarly, with the 'T' pens, the most preferred place to lie was also in the corners (Areas 5, 6, 8 and 9).

Although many sows did use the free space, it was at a much lower level than expected. This could be due to several possibilities, such as lower ranking animals feeling threatened by higher ranking sows, or larger sows utilizing the free space due to crowding in the stalls. It has been suggested that due to the rigorous selection for improved meat production, the body shape of modern domestic pigs has been changed (Whittemore, 1994). Selection has resulted in larger pigs which can have difficulty lying and standing, and may not fit comfortably into conventional stalls (24 inches wide).

The areas where sows have shown a preference to lie down all have more walls than the other available areas, which can act as support. This finding is in agreement with previous studies (mostly in the farrowing environment) where sows also show preference to use support

(Free space utilization ... continued on page 11)

(Benchmarking ... continued from page 1)

Table 1.

	Top 10%	Avg	Bottom10%	Top vs Bottom
Sow mortality rate	4.4%	6.7%	10.5%	57% decrease
Marketed hogs/mated female/yr	24.0	22.3	20.6	16.5% better
Whole herd feed conversion	2.98	3.25	3.44	13.4 % better

Take for example a survey of western Canadian mid-sized farrow to finish producers that was recently shared with me. The top 10% of producers demonstrated significant productivity measure improvements over the average and bottom 10% for key measures such as shown in Table 1.

Looking at these measures we are immediately aware of two things: 1) The variation within each measured factor is large, and 2) with such large variation there is significant motivation to do better regardless of where your particular herd stands. There is a third factor we should be aware of – that is this variation in productivity pales in comparison to the variation in financial performance seen between these same farms (Table 2 — all financial measures taken for same time period as productivity data above).

The Bottom Line

Accepting the inaccuracies that come with such comparisons there is significant opportunity to improve productivity and profitability through comparison (benchmarking) to other similar farms. Below are a few articles that can be found in the Pork Insight database located on the Prairie Swine Centre website that will assist in our pursuit of improved profitability, and one article that encourages the use of statistical control charts to detect changes in herd productivity.

Profit Sensitivities to Feed Price and Pig Price with Varying Production Levels (Banff Pork Seminar, 2009)
http://www.prairieswine.com/database/details.php?id=39200

Table 2.

	Top 10%	Avg	Bottom 10%	Top vs Bottom
Revenue per hog marketed	154.75	145.28	134.47	15% better
Utilities per hog marketed	$2.58	$3.65	$5.21	50.5% better
Margin over recorded cost*	34.74	25.62	12.75	2.72 times better

* note that labour, depreciation, interest removed to allow for comparison of variable costs only

The reason benchmarking works is it provides a tool to see beyond our current practices. Termed “paradigm blindness”, individuals become so focused and or entrenched in their operation they fail to see other possibilities to address the activity.

Top 10 Cost Cutters and Revenue Generators (Centred on Swine, 2004)
http://www.prairieswine.com/database/details.php?id=1847

Control charts applied to simulated sow herd datasets (Germany, 2009)
http://www.prairieswine.com/database/details.php?id=39056

Common Misconceptions In Benchmarking

(summarized from J. Deen, S. Anil University of Minnesota. published in Farms.Com, Benchmark 2009 Edition)

#1 Confusing benchmarking with participating in a survey

#2 Thinking there are pre-existing benchmarks to be found.

#3 Not all production and economic parameters can be benchmarked – example service delivery and customer satisfaction.

#4 The process is too large and complex to be manageable.

#5 Benchmarking is not research

#6 Misaligned benchmark targets – what is the overall farm strategy that you are trying to benchmark?

#7 Picking a topic that is too intangible and difficult to measure

#8 Not establishing a baseline

#9 Not researching benchmarking partners thoroughly

#10 Not having a code of ethics and contract agreed upon with partners.

For complete article see **www.benchmark.farms.com,** click on Disciplined Benchmarking

(Comparative evaluation ... continued from page 7)

"...compared to a grow-finish room with conventional forced-air convection heater, the room with infrared radiant heating system has consumed more gas but used less electrical energy ..."

showed that temperature variation was slightly higher in the second trial; this could be due to the colder ambient temperature since the average ambient temperature during the trial was 19.2 °C colder than during the first trial. Additionally, the setpoint temperatures for both rooms during the first 3 weeks of the test period was 23.7, 22 and 20 °C for the first, second and third week, respectively. The observed range of deviation above and below the setpoint temperature in all the locations in the Treatment room were 0.9 and 1.8 °C respectively, while the corresponding values in the Control room were 0.4 and 1.3 °C, respectively.

The average relative humidity readings recorded in the middle and near the exhaust fan in the forced-air heater room (59%) was slightly higher than those in the radiant heater room (57%). With regard to ventilation, average rates observed in the Control and Treatment rooms were 3269.7 and 3125.0 L/s, respectively during the first trial and 836.7 and 644.8 L/s, respectively in the second trial.

Over the course of the trials, hydrogen sulphide (H_2S) and carbon monoxide (CO) concentrations in both rooms were usually at levels barely detectable by the sensors with average concentrations of less than 1 ppm for either gas. However, during pit pulling events, concentrations of H_2S were observed to spike to considerably high levels with peak concentration of 91 and 97 ppm in the Control and Treatment rooms, respectively. Ammonia and carbon dioxide levels were relatively similar in both rooms with average concentrations below 10 and 2000 ppm, respectively.

Pig performance

The average daily gain (ADG), average daily feed intake (ADFI), and mortality rate were monitored during the two trials to evaluate the effect on hog performance. Both ADG and ADFI were found to be relatively similar in both Control and Treatment rooms. Average ADG values from the two trials were 0.95 and 0.94 kg/pig-day, while ADFI values were 2.64 and 2.55 kg/pig-day for the Control and Treatment rooms, respectively. Feed intake of pigs in the Control room was slightly higher than in the Treatment room, hence resulting to a slightly faster growth rate. During the first trial, average mortality rates of 1.8% and 4.0% were recorded in the Control and Treatment rooms, respectively, and zero mortality was recorded in both rooms during the second trial. Based on observations during daily animal health checks, mortalities in both rooms were health related, such as incidence of lameness and infections, and were unlikely to be related to heater performance.

The Bottom Line

Observations from the two completed trials so far indicated that compared to a grow-finish room with conventional forced-air convection heater, the room with infrared radiant heating system has consumed more gas but used less electrical energy, had a more uniform temperature distribution within the room, and had no adverse impact on the growth performance of the pigs. These observations will need to be verified after all trials are completed and appropriate statistical tests are conducted.

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(Free space utilization ... con't from page 9)

when lying down. Marchant et al., (2001) reported that 89% of lying down events were carried out using either a sloping wall, or a wall fitted with a piglet protection rail.

With the transition towards group sow housing it is important that scientific research is used to design the optimum housing system which can facilitate social interactions and minimize aggression and competition. Future research resulting from this study will focus on methods for encouraging the sows to utilize the free space areas. This will include improving the comfort of the free space area with rubber mats, providing environmental enrichment, or possibly allowing sows access to the free area in different social groups (alternate groups) i.e. gilts and sows.

The Bottom Line

Group housing of sows is recognised as an alternative system for improving animal comfort and well-being however, we found that not all sows used the free space areas on a regular basis, or for extended periods of time. It is apparent that the older, heavier sows are utilising the space the most, therefore further research in this area will involve reducing social stress perceived by younger animals, and making the free space area more comfortable.

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Personal Profile

Fiona Lang

Fiona Lang was raised in a small town on the west coast of Scotland. Not knowing what career she wanted to do, other than working with animals, she graduated from Glasgow University in 2003 with a degree in Zoology, which was followed by a M.Sc. in Applied Animal Behaviour and Animal Welfare from The University of Edinburgh. It was during the M.Sc. program that she became more familiar with the study of animal behaviour in farm animals and found her ideal career. After working as a research technician for 1 year she went on to complete a Ph.D. in dairy cow feeding behaviour at The University of Edinburgh and the Scottish Agricultural College. Fiona is particularly interested in how we can optimise housing designs for farm animals to improve animal welfare, and recently took up her post as a Research Associate at Prairie Swine Centre in October 2009. Despite previously working mostly with cattle and sheep, she is looking forward to the challenges of working with sows, and improving sow housing.

Jennifer Brown

Jennifer Brown has recently completed her Ph.D in animal behaviour at the University of Guelph, where she studied how the temperament and handling experience of pigs influence their behaviour and stress physiology at slaughter and meat quality. Jennifer has a diverse academic background, including a degree in Fine Arts, and B.Sc. and M.Sc. degrees from the University of Prince Edward Island. Her M.Sc. research was in toxicology, and looked at the neurotoxic mechanism of amino acids produced by marine algae. Before beginning her PhD she lived and worked in PEI for several years doing research in toxicology and clinical chemistry, and kept a small hobby farm.

Coming Events

Swine Breeding Workshop
April 29-30, 2010
Edmonton, AB

World Pork Expo
June 9 to 11, 2010
Des Moines, IA

Ontario Pork Congress
June 22-23, 2010
Stratford, ON

International Pig Veterinary Society (IPVS)
July 18-21, 2010
Vancouver, BC

Allen D. Leman Conference
Sept. 18-21, 2010
Minneapolis, MN

Saskatchewan Pork Industry Symposium
Nov 16-17, 2010
Saskatoon, SK

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