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Large Group Housing - A Review

Dr. Gonyou in a large group pen, observing the reaction to human contact. One of the additional benefits of Large Group Housing is greater interaction with barn staff on a daily basis, resulting in increased familiarity and perhaps leading to improved handling.

Lee Whittington, MBA, Harold Gonyou, PhD

Over the past 5 years the concept of large groups of grower-finisher pigs has expanded. Not only does it include extensive (outdoor raised) operations and hoop structure barns but the conversion or special construction of conventional housing modified to accommodate groups much larger than the traditional 20 pigs per pen. Why? There were four drivers: A desire to reduce construction costs by simplifying penning and barn design; herd sizes were becoming large enough that large groups could be formed without commingling ages; electronic sorting technology provided a means to deal with the critical task of accurately separating at market without high labour costs; and finally improved use of space could improve profitability and relieve the crowding effect brought on by higher sow productivity over the past decade.

Balancing these forces for change were the concerns that large group housing could lead to poorer performance, increased development of vices (tail biting, flank biting), and increased weight variation (variable growth rates). In fact these three concerns were identified in scientific papers and production manuals in the late 1980's (English, et. al 1988).

Recently a series of studies carried out at Prairie Swine Centre and elsewhere have

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Feed Processing and Nutritional Quality among Wheat Classes Fed to Weaned Pigs

Ruurd T. Zijlstra, David Overend [1],
David R. Hickling [2],
P. Howard Simmins [3],
and John F. Patience

Summary

Feed processing and nutritional quality for CPS and Durum wheats have traditionally been expected to be lower than for Hard Red Spring (HRS). Performance of weaned pigs was compared among six wheat classes, whilst considering particle size and diet pellet quality. Results indicated that feed processing quality and growth performance did not differ among wheat classes. Weaned pigs fed various classes of wheat including CPS and Durum grow similarly.

Introduction

The processing and nutritional quality of wheat is expected to vary among classes; CPS and Durum wheat are currently segregated. A range in wheat protein and fibre or non-starch polysaccharide (NSP) content may partly cause quality variation. The present study was designed to test whether wheat class by itself impacts feed processing or nutritional quality.

Experimental Procedures

Two cultivars from each of six classes (CPS White and Red, HRS, Durum, Hard Red Winter (HRW) and Hard White (HW)) were collected (Table 1). Protein ranged from 12.2 to 17.4% and total NSP from 9.0 to 11.5% (Table 2). A 3-week growth and digestibility study was conducted with 12-kg weaned pigs (PIC; 39-day-old; 4 pigs/pen, 12 pens per cultivar), which were fed pelleted 65%-wheat diets (3.5 Mcal DE/kg; 3.4 g dig. lysine/Mcal).

Results and Discussion

Wheat particle size ranged from 536 to 734 mm (10/64"-screen) (Table 2). Pellet Durability Index was 96 for all diets. Feed processing quality was thus excellent for all wheat classes. In the growth study, average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency did not differ among wheat classes for day 0 to 21 (Figure 1). However, some minor differences were observed in the first week. For example, ADG for Durum was 9% lower than for HRW, and similar among other classes; ADFI for HW was 7% lower than for HRW, and similar among other classes. Finally, diet energy digestibility (and thus DE content) was lowest for CPS Red (86.5%), medium for CPS White, HRS and HW (87.2 to 87.5%) and highest for HRW and Durum (88.6 & 88.9%) (Figure 2).

Table 1. The Canadian Wheat Board classes and popular names for the used wheats.

Canadian Wheat Board Class	Popular Name
Canadian Prairie Spring White	CPS White
Canadian Prairie Spring Red	CPS Red
Canadian Western Red Spring	Hard Red Spring (HRS)
Canadian Western Amber Durum	Durum
Canadian Western Red Winter	Hard Red Winter (HRW)
Canadian Western Hard White	Hard White (HW)

Table 2. Protein and NSP content and particle size of the ground wheat. Each value represents one of two cultivars per class.

Wheat class	Protein (% as is)	Total NSP (% as is)	Particle size (μm)
CPS White	15.1, 16.1	11.3, 11.4	591, 700
CPS Red	12.4, 15.8	11.0, 11.3	556, 631
HRS	15.4, 17.1	10.8, 11.5	640, 708
Durum	16.3, 16.8	9.0, 10.1	624, 734
HRW	12.2, 13.7	9.7, 10.9	536, 636
HW	16.5, 17.4	10.9, 11.3	629, 724

Implications

Protein but not NSP content varied among 12 wheat cultivars harvested in western Canada in 2001. Wheat protein content was "corrected for" during diet formulation and did not affect pig performance. Wheat NSP content was low overall, indicating that all 12 wheat samples were of excellent nutritional quality. Still, DE content ranged 7% and was highest for Durum. Reductions in ADG and ADFI for CPS and Durum wheat were limited to the first two weeks, and did not exist after 3 weeks. In conclusion, despite variations in wheat DE content, weaned pigs fed various classes of wheat including CPS and Durum performed effectively, and wheat class by itself was not a cause for a range in feed processing or nutritional quality.

CPS and Durum wheat can be processed and fed to weaned pigs without compromising growth performance.

Acknowledgements

Strategic program funding provided by Sask Pork, Alberta Pork, Manitoba Pork, and Saskatchewan Agriculture and Food Development Fund. Project funding was provided by the Canadian Wheat Board, Canadian International Grains Institute, Feed-Rite (Ridley Inc.), Danisco Animal Nutrition, Degussa, and Quality Assured Seeds.

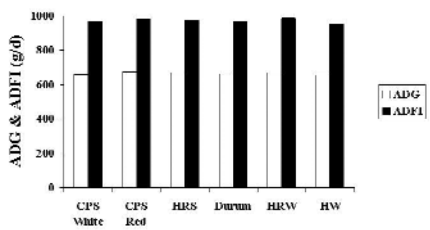


Figure 1 Effects of wheat class on average daily gain (ADG) and feed intake (ADFI) of weaned pigs in the 3-week growth study.

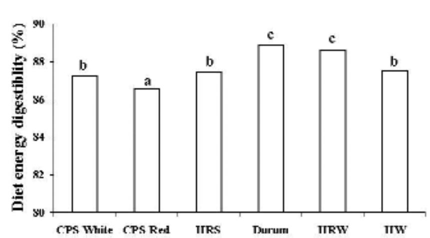
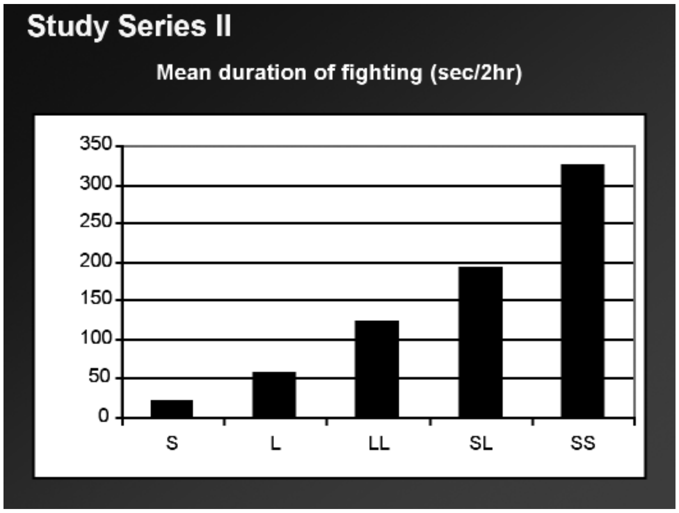


Figure 2 Effect of wheat class on diet energy digestibility measured in weaned pigs.



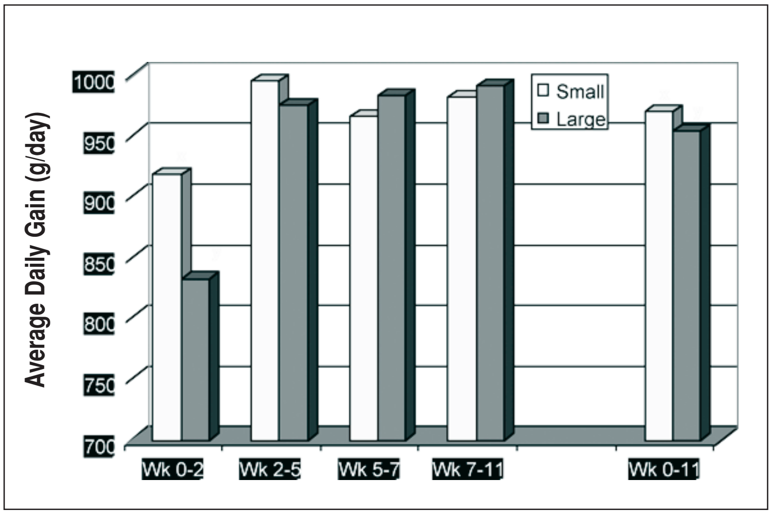


Figure 1.

Figure 2.

Continued from page 1
confirmed what pioneering pork producers suspected from their observations – there is little or no negative impact from group size on these three key areas.

Proof #1 – Aggression declines in larger groups

Aggression is primarily a problem when groups are first mixed, group size does not seem to play a significant role in either the length of time aggression is observed or the severity. Aggression declines significantly after the first 2 hours in all group sizes studied (10,20,40,80 pigs per pen). In fact one study showed significantly less aggression in the larger group (80 pigs per pen) versus the other group sizes. To explain this a second series of studies was developed that looked at aggression over the first 3 days post-mixing. The large groups exhibited slightly less aggression than the small groups on day one, with no significant differences on days 2 or 3.

Figure 1. Aggression measured by minutes of fighting following mixing. Pigs from small groups (S) and Large groups (L) were mixed in various combinations.

The source of the pigs and their previous experience seems to have a much greater bearing on aggression being observed in the grower finisher barn than does the size of the group. In this study the pigs were mixed based on their pen of origin. That is pigs from large pen environments were mixed with either pigs from other large pens or pigs from small pens. Pigs from small pens were treated accordingly by mixing either with pigs from large pens or pigs from other small pens. In a trial which observed aggression over a 12 week period, it was determined that the pigs with experience from a large pen tended to exhibit more 'tolerance' and there was significantly less aggression in these pens. The highest amount of aggression was exhibited by pigs from small pens.

There is reason to believe that one of the contributors to good results in large groups is that the pigs develop a social tolerance when housed in large numbers, pigs use their space differently than pigs raised in small social groups. This builds further on observations previously reported that pigs in large groups utilize their whole pen environment in large group settings and are not territorial in their use of space for eating, sleeping or deficating.

Proof #2 – Average Daily Gain is maintained in large groups

Eight 11-week trials of 4 groups of 18 (small group) and 2 groups of 108 (large group) grower-finisher pigs per pen were evaluated. Equal numbers of barrows and gilts were used in each group. Feed was made available free choice from single space wet/dry feeders, with one feeder hole for every 9 pigs. Floor space in the fully slatted room was equal for the two group sizes.

Pigs in smaller groups had a higher growth rate (10%, $P<0.05$) during the first 2-week period. ADG for the entire grower-finisher period was slightly higher (2%, $P<0.05$) for the pigs in the smaller groups compared to the larger groups (Figure 2).

During week 2-5 and week 7-11 ADG was similar between the two group sizes and no difference was observed on feed efficiency for either of these periods.

The overall effect of a slight reduction in ADG has been seen by two other research groups (Wolter, USA <2%; and Turner, UK also <2%).

Proof #3 Body Weight variation does not change with increasing size of the group

For the same series of experiments discussed under average daily gain, variation in body weight was also measured. Upon entry to the room, all pigs were weighed. The pigs assigned randomly to the small groups had an average body weight of 31.9 kg and a CV (Coefficient of Variation) of 14.8%. The pigs assigned to the large groups began the trial at an average body weight of 31.6 kg and a CV of 15.7%. The CV is a measure of uniformity of the population and is calculated by taking the standard deviation and dividing it by the mean weight of the group, the higher the CV the lower the uniformity across the group. For example, a CV of 10% is a more uniform group than one with a CV of 25%.

From a barn management perspective we are mostly concerned about the amount of variation in the group as they near market weight. An increase in variation (greater spread of weights in group) would mean a longer period of weighing and sorting at market. In the worst case this increased variation might not only lead to a longer shipping period but also an increase in total days that the group needs to stay in the barn to reached desired weights.

At the end of the experimental period, variation in pig body weight within a group was similar between the two groups. The small group finished with a CV of 9.6%, and the large groups animals finished with a CV of 10.3%.

Project funding provided by: Manitoba Pork, Natural Science and Engineering Research Council, and Agriculture and Agri-Food Canada.

The Bottom Line

Although pigs in larger group sizes tend to have a slight reduction in overall average daily gain, in general, the performance of the pigs in larger group size was not inferior to the smaller group size.

In an analysis of large group housing completed as part of the VIDO-sponsored Considerations For Large Group Housing, the value of improved sorting techniques using electronic sorters, combined with reduced housing costs and better space utilization resulted in a net benefit of $4.77 per pig when using a group housing system.

Practical Application of Enzyme Supplementation in Swine

Ruurd T. Zijlstra
Prairie Swine Centre Inc.,

Introduction

Application of enzymes to improve nutrient digestibility of plant-based feed ingredients for swine and poultry has now been studied for decades. Initially, the main focus was phytase to break down the phytate molecule and release the attached phosphorus molecules. In the last two decades, enzymes to assist digesting NSP (non-starch polysacharides - or fibre fractions) were developed, tested, and commercialized. In the meantime, enzymes to assist digesting starch, protein and fat have been tested as well. A large array of chemical characteristics exists among plant-based feed ingredients, and success of enzyme application will depend on these characteristics. The substrate must match the enzyme and be a limitation for nutrient digestibility or voluntary feed intake. Two diet formulation methods exists to apply enzyme treatments in practice: (1) formulate diets to a regular nutrient content and supplement with an enzyme, while hoping for an improvement in feed efficiency, or (2) formulate diets to a reduced nutrient content and count on an uplift by the enzyme to a regular nutrient content, while reducing feed costs. An overview of considerations and practical application of enzyme supplementation in swine is presented here.

Ingredients

Seeds of plant crops or fractions thereof each contain some of the three main energy categories: carbohydrates [divided into sugars, starch and non-starch polysaccharides (NSP)], protein, and oil (fat). Among the listed feed ingredients, a large array in these energy components exist, ranging from 10 to 37% NSP, 14 to 63% starch, 9 to 47% protein, and 1 to 5% fat (Table 1).

Table 1. Concentrations of starch (+ sugars), NSP, protein, and fat (% as is) of seven selected feed ingredients (adapted from CVB 1994).

Crop	Starch	NSP	Protein	Fat
Wheat middlings	25	37	16	4
Oats	39	31	11	5
Barley	54	18	11	2
Soybean meal	14	17	47	2
Field peas	47	14	23	1
Wheat	61	10	12	2
Corn	63	10	9	4

In least-cost diet formulation, the greatest cost-pressure is against digestible or available energy (Zijlstra et al. 2001). Overall in swine nutrition, the inverse relationship between NSP content and energy digestibility has been well described for several feed ingredients, for example wheat (Zijlstra et al. 1999) and barley (Fairbairn et al. 1999). Logically, enzymes that degrade fiber and thereby improve energy digestibility or voluntary feed intake will thus have a high chance to be beneficial economically, whereas phytase to improve phosphorus digestibility may also reduce nutrient excretion and thereby improve sustainability of the swine industry.

Among ingredients, large differences in digestibility of the main macronutrients exist (Figure 1). Among the cereal grains, oats has the lowest digestibility of crude fiber, then barley, wheat, while corn has the highest digestibility of crude fiber. Both peas and soybean meal have a high digestibility of **crude fiber**. By-products from value-added processing, including wheat middlings from wheat flour milling, generally have a lower nutrient digestibility than the parent cereal. Digestibility of other carbohydrates, including starch, sugars, and the remainder of the fiber fractions was lower for wheat middlings, oats and barley compared to the other four feed ingredients. Protein digestibility followed a similar pattern as digestibility of other carbohydrates with the highest protein digestibility observed for soybean meal. According to the database (CVB 1994), fat digestibility shows a large variation among feed ingredients. Phosphorus digestibility was consistently below 40%, likely due to the phytate contained in plant-based feed ingredients.

The data set for nutrient digestibility suggests which ingredients that enzyme supplementation or other technological treatments will improve nutrient digestibility. Using this approach, barley and wheat, and more recently wheat byproducts have gained attention for supplemental enzymes treatment to improve nutrient digestibility, whereas corn and soybean meal only have gained sporadic attention.

Enzymes in wheat-based diets

For diets based on either wheat or barley, improvements in energy digestibility, growth performance or voluntary feed intake have been achieved often but not consistently using supplemental enzymes. As indicated in Figure 1, more opportunities exist with wheat and barley to improve digestibility of crude fiber and therefore energy digestibility using supplemental enzymes or other feed processing technologies such as particle size reduction.

Arabinoxylans or xylans are the main NSP in wheat that limit energy digestibility in swine (Zijlstra et al. 1999). Logically, xylanase is an enzyme used for wheat diets to improve energy digestibility. Energy digestibility might also be improved using particle size reduction; by grinding

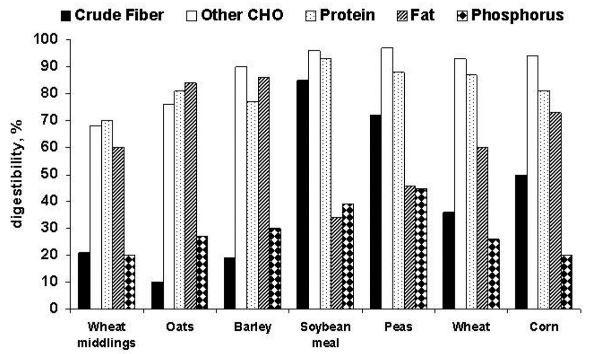


Figure 1. Digestibility of the macronutrient components and phosphorus of seven selected feed ingredients in grower-finisher pigs (adapted from CVB 1994). Other CHO stands for other carbohydrates (starch, sugar, and the remainder of the fiber fractions).

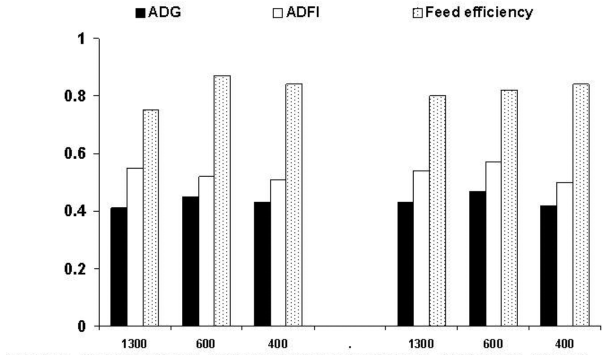


Figure 1. Effect of xylanase supplementation on ADG (kg/d), ADFI (kg/d) and feed efficiency of weaned pigs fed diets based on wheat (Mavromichalis et al 2000)

the wheat more finely, the relative surface area of the ground particles increases and nutrient digestibility might be improved. The combination of xylanase supplementation and particle size reduction was studied in wheat-based diets (Mavromichalis et al. 2000). Particle size reduction improved feed efficiency linearly, but xylanase supplementation did not affect feed efficiency or dry matter digestibility. In an accompanying study with finisher pigs, xylanase supplementation tended to improve nutrient digestibility and reduced feed intake while growth performance was maintained (Mavromichalis et al. 2000).

Wheat samples can have a wide range in total xylan content, and this wide range is inversely related to energy digestibility (Zijlstra et al. 1999). The wheat sample that is included in the diet can thus affect the chance of observing a beneficial effect of xylanase supplementation. Indeed, in recent experiments in our laboratory, the beneficial effect of xylanase supplementation and particle size reduction depended on the wheat sample that was included in the test diet (Zijlstra et al. 2004), similar to previous experiments conducted with barley differing in NSP profile (Zijlstra et al. 1998). The latter indicates that feed evaluation and processing decisions should be integrated to maximize the beneficial effects of enzyme supplementation or particle size reduction.

Wheat by-products from dry milling for flour production are gaining increasing attention in the swine industry. These by-products are generally available at a reduced cost; however, much research will have to be completed to characterize and improve the nutritional value of the by-products. However, wheat by-product and other by-products imported from overseas may be beneficial to fill the expected gap in availability of feed corn in North America (Wisner and Baumel 2004). Enzyme supplementation may play a key role in maximizing the existing opportunities for inclusion of alternative feed ingredients in swine diets.

Practical application

Two diet formulation methods exist to apply enzyme treatments in practice: (1) formulate diets to a regular nutrient content and supplement with an enzyme, while hoping for an improvement in feed efficiency, or (2) formulate diets to a reduced nutrient content and count on an uplift by the enzyme to a regular nutrient content, while reducing feed costs. In most experiments including the experiment discussed in this paper, enzymes are included in the diet as a top dress: diets are formulated to meet the nutrient requirement. A second approach is to include enzymes in the diet to deal with the expected variation in ingredient quality. Hopefully in the future, rapid screening of ingredient samples will allow us to match the substrate with the enzyme and allow the enzyme dose to be adjusted depending on the substrate content in the ingredient or complete diet.

For commercial swine production, a predictable growth performance is an important component of financial viability. With least-cost diet formulation, the greatest cost pressure is against available or digestible energy content of diets (Zijlstra et al. 2001).

Knowledge to the expected improvement of energy content of feed ingredients using supplemental enzymes is key. Using this approach is valid for enzymes providing an increase in energy digestibility and thus digestible energy content. The formulated diet energy content is reduced by the amount of "uplift" expected by the supplemental enzyme, other nutrients are maintained at the previous level, and if needed, energy to lysine ratio is adjusted. Due to the reduced energy content, diet cost is reduced and financial room is available to include a supplemental enzyme into the diet. The uplift ensures that the expected dietary energy content is achieved and that swine growth performance and carcass characteristics can be maintained.

With least-cost diet formulation, the greatest cost pressure is agianst available or digestable energy content of the diet — This is where enzymes can help.

The Bottom Line

Feed ingredients have a range in content of energy-providing macronutrients. Especially digestibility of the crude fiber fraction has a large range in nutrient digestibility among feed ingredients. The range in fiber digestibility is directly and inversely related to a range in digestibility of energy, the most expensive nutrient contained in swine diets. Supplemental enzymes may be beneficial to improve energy digestibility. Specific substrates and thus enzymes are beneficial for wheat and barley, but multi-enzyme cocktails were beneficial for diets based on corn and soybean meal. By taking the expected uplift in energy digestibility and thus energy content into consideration during least-cost diet formulation, diet cost can be reduced. This approach should make supplemental enzymes cost effective addition to the diet.

Response of Growing and Finishing Pigs to Dietary Energy Concentration

J. F. Patience, A. D. Beaulieu and R.T. Zijlstra

The primary objective of pork production is to produce lean meat in a cost effective and sustainable manner. From a nutritional perspective, energy is perhaps the most critical nutrient, because it is the most expensive to provide in the diet and because gut capacity may limit the ability of the pig to consume sufficient quantities to achieve their full genetic potential for growth. It is generally assumed that feeding a higher nutrient density diet will enhance pig performance. The only outstanding question in most people's minds is at what point does the higher cost of the high energy diet exceed the value of improved animal performance.

Confounding this logic is recent research at the Prairie Swine Centre showing that pigs do not always respond to higher energy diets with improved performance. Indeed, we have completed no less than 4 studies with nursery pigs showing no increase in growth rate when dietary energy was increased. Have we been wrong all these years in feeding high energy diets in order to achieve improved performance?

There are other reasons for wanting a better understanding of how the pig uses energy. For example, our knowledge of amino acid metabolism is rapidly increasing, with literally dozens of experiments on this subject completed each year. We are quickly getting to the point where a nutritionist can estimate with a reasonable degree of accuracy, the optimum level of lysine and other amino acids required for a given farm operating under a given financial environment. However, before we can take full advantage of our knowledge on amino acids, we must have an equivalent understanding of energy – and that is certainly not the case at the present time.

Clearly, there is a compelling need for much more information on the response of the pig to dietary energy concentration, whether they are in the nursery or in the growout barn. Not surprisingly, then, this has become a primary focus of our current research program. We are directing particular attention to the growing and finishing pig, since this is where the bulk of feed expenditures occur.

In our most recent experiment, we put a total of 300 pigs – 150 barrows and 150 gilts - on test from 31 kg to market at 115 kg. The experiment was carried out in three phases: 25 to 50, 50 to 80 and 80 to market. Five energy levels were compared, ranging from a low of 3,090 kcal DE/kg to a high of 3,570 kcal DE/kg; these levels were selected to represent the range in DE that might reasonably be utilized in a western Canadian context. The lysine:DE ratio was held constant, to ensure that amino acid levels did not limit the ability of the pigs to respond to dietary energy concentration. Diets were based on barley, wheat, soybean meal, canola meal and canola oil and were fed as a mash. The specifications of the diets are presented in Table 1.

> The return over feed cost favoured the lowest energy diet by more than $10 per pig sold.

We were very surprised to observe in this experiment that the pigs grew at the same rate per day, irrespective of dietary energy concentration. Average daily gain averaged 1.02 kg/day across all diets, and there were no statistically significant differences due to diet (Table 2). Barrows grew about 80 g/d faster than gilts, and the heavier pigs at the start of the trial grew 50 g/d faster than the lighter pigs.

As expected, feed conversion improved with increasing energy concentration, such that a 15.5% increase in diet DE, from the lowest to the highest energy diet, resulted in a 16.7% improvement in feed efficiency (Table 2). The improvement in feed efficiency confirms that the pigs were utilizing the additional energy present in the higher energy diets. We also determined the actual DE as compared to the formulated DE, and found them to be in close agreement (Table 1). We can therefore conclude that the absence of a growth response was not due to errors in formulating or manufacturing the diets.

The gilts had only a slight advantage over barrows, with respect to feed conversion and this difference was statistically significant. There was no significant difference in the feed conversion of the pigs that started the experiment in the light group as compared to the heavy group.

No study on dietary energy would be complete without carcass information. Increasing dietary energy had no effect on loin thickness, but it did result in increased back fat and decreased lean yield (Table 3). The difference in backfat, in the order of 2.6 mm, was much larger than expected.

Not unexpectedly, barrows were fatter than gilts, by 4.4 mm and had a lower index, by 3.3 units. There were no differences between the light and heavy groups, which would be expected, since they were both marketed at the same weight.

We also looked at the effect of dietary energy on the variability in performance and saw no effect. This is not the first time that we have observed no effect of feeding higher quality diets on variation.

Perhaps the most critical results are the economical analysis. Increasing dietary energy concentration increased feed costs by $11.75 per pig, from $37.76 to $49.52. Considering the revenues generated, the return over feed cost differed by $10.37 per pig sold across the range of diet DE levels.

The results of this experiment agree with earlier studies conducted at the Prairie Swine Centre in the nursery pig. However, they are quite contrary to what the industry expects to happen when higher energy diets are fed in the growout period. Certainly, we would not recommend that pork producers change their feeding program on the basis of a single experiment. However, given the very large differences in profitability observed in this experiment, we would strongly urge producers to re-evaluate their existing programs and perhaps run their own simple study to determine if they are feeding the optimum energy levels on their farm.

This experiment was conducted in a barn where feed intake is quite high. Because the results were unexpected, and because so many dollars are resting on the correct selection of dietary energy, we are going to repeat this experiment in another commercial barn, to see if these results can be replicated. We should have the results of that study next spring.

Table 1. *Nutrient specifications for the experimental diets used in each of the three phases. Only the high and low energy diets are presented; the other diets were arithmetic intermediates.*

	Phase I Mcal DE/kg		Phase I Mcal DE/kg		Phase III Mcal DE/kg	
	Low	**High**	**Low**	**High**	**Low**	**High**
DE, Mcal/kg						
- Formulated	3.05	3.61	3.05	3.61	3.05	3.61
- Actual	3.06	3.61	3.05	3.61	3.06	3.61
gLys/DE						
- Females	2.90	2.90	2.55	2.55	2.05	2.05
- Males	2.80	2.80	2.45	2.45	1.95	1.95
Ca	0.75	0.75	0.76	0.75	0.65	0.64
P	0.66	0.65	0.66	0.65	0.55	0.55

Above table shows only the highest and lowest energy diets. Intermediate energy levels were obtained by blending appropriate portions of these diets to achieve the desired final DE concentration, as follows: 3.19, 3.33 and 3.47.

Table 2. *The effect of dietary energy density, gender and initial bodyweight on growout performance.*

	Diet (Measured DE, Mcal/kg)								Gender			Weight Group		
Parameter	**3.09**	**3.24**	**3.34**	**3.42**	**3.57**	**SEM**	**P value**	**Regression**	**Male**	**Female**	**P value**	**Heavy**	**Light**	**P value**
Initial wt., kg	31.2	31.1	31.5	31.2	31.1	0.2	0.68	NS[a]	31.7	30.7	0.001	33.6	28.8	0.0001
Final wt., kg	115.1	115.5	115.3	115.0	115.6	0.4	0.82	NS[a]	115.7	114.9	0.03	114.4	115.2	0.51
ADG, kg	1.00	1.02	1.03	1.01	1.05	0.01	0.13	NS[a]	1.06	0.98	0.0001	1.04	0.99	0.0001
ADFI, kg	2.76	2.69	2.67	2.59	2.49	0.03	0.001	L[b]	2.80	2.48	0.0001	2.72	2.56	0.0001
FCE	0.36	0.38	0.38	0.39	0.42	0.01	0.001	L[b]	0.38	0.39	0.002	0.38	0.39	0.17

Table 3. *The effect of dietary energy density, gender and initial bodyweight on carcass value.*

	Diet (Measured DE, Mcal/kg)								Gender			Weight Group		
Parameter	**3.09**	**3.24**	**3.34**	**3.42**	**3.57**	**SEM**	**P value**	**Regression**	**Male**	**Female**	**P value**	**Heavy**	**Light**	**P value**
Index	113.81	112.91	113.45	111.70	113.24	0.48	0.04	NS[a]	111.38	114.67	0.0001	113.17	112.88	0.50
Yield, %	61.58	61.13	60.88	61.14	60.63	0.18	0.01	L[b]	60.08	62.07	0.0001	60.92	61.22	0.07
Fat, mm	16.83	17.79	18.33	18.62	19.39	0.34	0.0001	NS[a]	20.38	16.01	0.0001	18.19	18.20	0.97
Lean, mm	61.65	60.55	62.72	60.25	61.06	1.06	0.52	NS[a]	59.93	62.56	0.009	61.22	61.27	0.96
Value, $/pig	111.36	111.63	111.67	110.20	112.75	1.16	0.65	NS[a]	109.33	113.72	0.0001	110.82	112.22	0.18
Premium, $/pig	5.56	5.33	5.53	5.06	5.00	0.18	0.10	L[b]	4.88	5.72	0.0001	5.26	5.33	0.67

Prices relate to market prices in place at the time of completing the experiment

Table 4. *The effect of dietary energy density, gender and initial bodyweight on days on test and feed cost during the growout period.*

	Diet (Measured DE, Mcal/kg)								Gender			Weight Group		
Parameter	**3.09**	**3.24**	**3.34**	**3.42**	**3.57**	**SEM**	**P value**	**Regression**	**Male**	**Female**	**P value**	**Heavy**	**Light**	**P value**
Days on test														
Phase 1	23.3	23.0	22.8	22.9	22.9	0.48	0.95	NS[a]	21.8	24.2	0.0001	20.33	25.67	0.0001
Phase 2	25.9	24.8	24.6	25.0	25.0	0.49	0.40	NS[a]	23.8	26.4	0.0001	24.63	25.50	0.06
Phase 3	35.4	35.8	36.8	34.6	34.0	1.07	0.42	NS[a]	34.0	36.6	0.009	34.37	36.27	0.05
Feed costs, $/pig														
Phase 1	8.36	8.96	9.38	10.39	11.36	0.19	0.001	L[b]	9.54	9.84	0.08	8.89	10.49	0.0001
Phase 2	12.00	12.70	13.93	14.81	15.46	0.25	0.001	L[b]	13.90	13.66	0.30	13.78	13.79	0.96
Phase 3	17.40	19.13	21.85	21.82	22.70	0.55	0.001	L[b]	20.93	20.23	0.16	20.56	20.60	0.95
Total	37.76	40.79	45.16	47.03	49.52	0.61	0.001	L[b]	44.37	43.73	0.25	43.23	44.87	0.005

NS[a] = non significant
L[b] = linear, significant, P<.05

Personal Profile

Brandy Street

Brandy Street was born in Moose Jaw, Saskatchewan, but spent the first eight years of her life on an acreage in Stony Beach, Saskatchewan. Eventually her family opted for city life and moved back to Moose Jaw. Brandy attended high school in Brandon, Manitoba before moving to Saskatoon to attend the University of Saskatchewan. In 2003, Brandy obtained her B.Sc. (Agr) from the University of Saskatchewan, majoring in Animal Science and minoring in Business.

Brandy has always had a love for animals. Therefore, throughout high school and into her university years, Brandy held various jobs working with livestock. Brandy first worked with pigs at Hanger Farms Inc. in Rivers, MB; a farrow-to-wean operation. There she was a farrowing technician. Brandy experienced all areas of pig production with Genex Swine Group, and was able to work with pigs, sheep, and dairy cattle at the University of Saskatchewan farm. Brandy first became a part of the Prairie Swine Center as a summer student in the summer of 2003, while working for the Ethology group headed up by Dr. Harold Gonyou. After her summer at the Swine Center, she decided to continue on with her schooling, enrolling in graduate school under the guidance of Dr. Gonyou.

Currently Brandy is working towards obtaining her M.Sc. degree. Her study focuses on the effects of crowding and large group housing on pig behaviour, welfare, and production. Brandy's study implements an allometric equation relating body weight to floor area in an attempt to most effectively determine the critical point at which crowding among grow-finish pigs begins. This equation can also be used to determine the rate at which productivity is depressed as further reductions in space allowance occur. For conventionally sized groups (10 – 40 pigs), growth is depressed by approximately 0.5% for every 1% reduction in space beyond the critical point of crowding. However, similar data based on large groups (over 100 pigs) is not yet available.

Past studies have indicated that average daily gain (ADG) is initially depressed for pigs housed in large groups when compared with pigs housed in small groups. Since the critical point of crowding for large groups has not yet been determined, it is not known whether the decrease in ADG was due to inadequate space, or due to the large group size itself.

The objectives of Brandy's experiment are (1) to determine the critical point at which productivity (ADG) of pigs in large and small groups is affected by crowding, (2) to determine the rate of depression in production as space allowance is further restricted beyond that critical point, and (3) to determine similar effects of crowding in large and small groups on feed intake, postural behavior, feeding behavior, injuries, and cortisol levels. Two groups sizes, 108 (large) and 18 (small) pigs/pen, will be used in conjunction with a crowded or uncrowded treatment.

Thomas Nortey

Thomas Nortey was born in the city Accra, in the West African country of Ghana. He obtained his B.Sc. (Hons.) degree in Agriculture with a specialization in Animal Science at the University of Science and Technology Ghana. He then worked as a production supervisor at the Tema Food Complex Corporation, one of Ghana's biggest agro-based industries. Within that time he gained experience working in the corporation's feed, flour, oil and fishmeal plants and also at the corporation's poultry/swine farms.

In 1996 he earned a M.Sc. degree in Animal Science at the Wageningen Agricultural University, in The Netherlands. Upon his return to Ghana, he worked at the Animal Research Institute of Ghana as an Assistant Research Scientist in the area of poultry nutrition.

He obtained a second M.Sc. degree from the University of Manitoba in 2002 with a specialization in Poultry Nutrition. In September 2003, Thomas joined the Prairie Swine Centre as a technician working with the nutrition group. In January 2004 he entered the Ph.D. program under the direction of Dr. Ruurd Zijlstra. His main focus is increasing the dietary inclusion rates of wheat by-products in growing pig diets. Feed costs can be reduced if nutrients trapped by the non-starch polysaccharide fractions found in wheat by-products can be made available to pigs. This would make for their higher inclusion rates in diets for growing pigs. Thomas's focus is to investigate the possible use of higher levels of wheat by-products in diets for swine through appropriate use of fibre degrading enzymes.

Coming Events

Saskatchewan Pork Industry Symposium
November 16-18, 2004
Saskatoon Inn
Saskatoon, Sasaktchewan

Pork Interpretive Gallery Silent Auction
November 17, 2004
In conjunction with the Saskatchewan Pork Industry Symposium

Manitoba Hog & Poultry Days
December 1 - 2, 2004
Winnipeg Convention Centre
Winnipeg, Manitoba

Banff Pork Seminar
January 18-21, 2005
The Banff Centre
Banff, Alberta

Focus On The Future Conference
March 8 - 9, 2005
Radisson Airport Hotel
Winnipeg, Manitoba

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