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In This Edition

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Enzyme supplementation and feed processing provides solutions for low quality grains

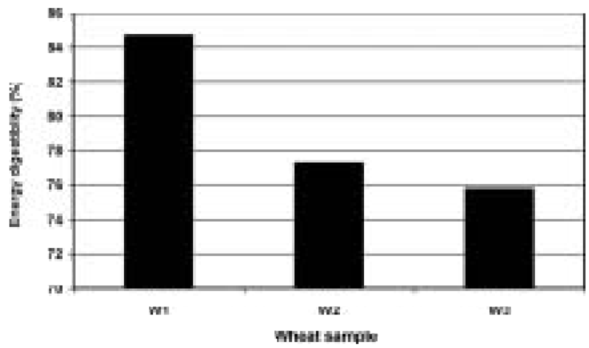

Figure 1. Energy digestibility for three wheat samples ground to ~650 mm (microns) that differed in neutral detergent fibre content (W1, 20.1; W2, 29.3; and W3, 35.7% NDF DM).

Ruurd T. Zijlstra, Ph.D.

The nutritional quality of wheat or barley can vary substantially (see previous Centred on Swine Volume 10 Number 3). Ignoring the existing variation may cause lower finished feed quality and thereby impact the pork producer economically through reduced growth performance.

For wheat and barley, reduced nutritional quality usually means a reduced digestible energy (DE) content. The reduction in DE content is almost completely caused by a reduction in energy digestibility, not by a reduction in the total amount of energy in the ingredient sample (or gross energy = GE content). The reduction in energy digestibility is usually related to an increase in fibre content of the grain.

Solutions for the use of low quality grains in diet formulations while maintaining growth performance should focus on two aspects: (1) correcting diet formulations to achieve the formulated diet DE content or (2) enzyme supplementation or feed processing to overcome the reduction in energy digestibility of the grain. Cost effective diet formulation depends on our ability to predict DE content of individual samples. The prediction of DE becomes even more difficult when fineness of grind and enzymes are considered. Equations to predict DE content of wheat and barley are presently being evaluated using the 2002-harvest.

To study whether a specific wheat sample would benefit from the effect of enzyme supplementation or feed processing, three samples of wheat were collected from the 2002-harvest. The three wheat samples (W1, W2, and W3) had similar crude protein (18.8 to 19.7% DM basis) but had a wide range in neutral detergent fibre (NDF) content (W1, 20.1; W2, 29.3; and W3, 35.7% DM basis).

Results of a digestibility study with grower pigs indicate that the increased fibre content for samples W1 to W3 indeed resulted in decreased energy digestibility (Figure 1) and reduced DE content from 3,680 to 3,320 kcal/kg DM, confirming the importance of ingredient evaluation

Continued on page 7

Top 10 cost cutters and revenue generators

Lee Whittington, BSc., MBA.

Lowering your cost of production and increasing revenues is more than just good business; for many producers this is the key to surviving the current market situation. Ideally, all farms are using many of the following ideas, but if not, now is the time to revisit this list and see if there are hidden profits waiting to be discovered. The following list focuses on changes, which can be implemented and monitored easily and inexpensively. In most cases, we have estimated the effect in terms of dollars per pig marketed.

1. The ideal feed formulation is dependent on animal weight and performance as well as cost of ingredients. The main driver to determining the frequency of diet reformulation is ingredient prices. When prices are rising and falling diets need to be changed more often. In volatile markets that could mean weekly, but for most producers this exercise is done each month, or whenever a major ingredient changes in price or availability.

   An example of the effect of diet reformulation on cost of production is seen in Table1 comparing a diet formulated on April markets but still in use in December. Those same specifications when reformulated using December prices produced a much different cost per tonne and reduced the cost per pig by $2.33 without changing performance.

   These example diets reflect only one farm's pricing scenario and are greatly affected by local availability and any forward contracting of ingredients. Major changes in ingredient prices that have affected most producers include the increase of approx. $100/tonne in soy prices in December, resulting in this farm's diets using more canola meal in grower and finisher diets. Experience suggests that regular reformulation of diets can reduce feed costs by $2-$4/pig sold.

2. Optimizing the use of ingredients like peas, lentils, and canola can reduce the cost of production in some commodity markets. Before incorporating any new ingredient, pork producers recognize that real hurdles exist such as available bin space, and local availability of seed cleaning byproducts. Usage rates will determine the value of any ingredient, one producer saved over $1.00 per pig by allowing grower diets to use up to 7.5% canola and finisher diets up to 10%. Pea usage up to approximately 30% of the diet is feasible. The net value of this tip will vary widely depending on the pricing and availability of alternative ingredients.

3. Selecting ingredients for their nutritional content not their bushel weight has been clearly defined as a significant way to ensure performance when considering distressed and other 'low quality grains'. Barley and various classes of wheat have been thoroughly examined for their dietary energy content and feed intake effect. Studies have shown that on average, a 1% rise in ADF (acid detergent fibre) results in a 93 kcal (3%) fall in DE (digestible energy) in barley. To make use of this information a pork producer needs to take representative samples of the grains they plan to use for the coming months and send these to the lab for protein, and either acid detergent fibre (ADF) for barley or neutral detergent fibre (NDF) for wheat. The level of savings will be dependent on having access to grains that provide energy in excess of their current market value (such as distressed grains), or improved confidence in a wider variety of ingredients such as the recent work on wheat which demonstrates all of the common wheat varieties provide similar energy values to pigs. (Annual Research Report 2002, pg 22)

4. Using phytase in starter and grower rations allows requirements to be met while reducing dependence on mineral phosphorus sources. The level of phytase usage varies depending on the concentration of the product selected, recent work supports that 250 FTU/kg of phytase added to diets of growing pigs maintained performance compared to diets without phytase. Until recently, most if not all practical grower and finisher diets as well as

sow diets were bringing Phytase into the Least Cost Formulation. Dropping grain prices have challenged last year's economics in this area. More information on phytase can be found in Centred on Swine Vol 10, No 3, Fall 2003.

5. Current marketing grids dictate that 'eyeballing' market weight isn't going to generate the maximum revenues. But what methods are available to balance workload and hitting the core? Knowing growth rates near market by weighing groups of pigs leading up to market allows you to use a system of weighing every two weeks. This method requires you weigh all pigs at the first shipping day. All pigs in the correct weight are shipped that day, but by knowing the typical ADG, you can project forward one week and mark those pigs with a distinct colour that will be ready next week, and different from the colour markings on the pigs to be shipped this week. There are herds that have improved their ability to market only 70% in the core and increase this to 90%+ using this method. The result is approximately $3.50 per hog at $1.10/kg market prices and $160/tonne finisher feed pricing.

Table 1. Cost Comparison April vs. December, 2003

	Grower Diet (35-60kg)	Finisher Diet (60-90kg)
April 2003 $/tonne*	215.41	190.00
December 2003, $/tonne*	215.58	177.59
December 2003, reformulated $/tonne*	201.91	160.76
$ Difference/tonne	(13.67)	(16.83)
Feed Usage Budget (kg/pig)	60	90
$ Difference/pig	$0.82	$1.51

*Unshrunk ingredient cost only

6. Marketing losses associated with demerits may be larger than one expects. A recent analysis of 2,562 market hogs found approximately 4.5% had demerits of some type. At $1.10/kg market price, those demerits account for a $0.42-$1.39/ckg or ($0.34–1.13/hog) discount when analyzed against the current Western Canadian grids. In addition, when the pool price rises to say $1.50/kg the demerit value increases to $0.52 - $1.84/ckg in lost value. Trim demerits include arthritis, bruising, skin conditions (such as frost bite) and abscesses. If these demerits are taking place in the handling and transport of the hogs there are steps to reduce these losses by reviewing handling facilities and practices in the barn, on the truck and at the plant.

7. Feeder adjustment is often seen as too much trouble because many feeders can be difficult to adjust. The performance of weanling pigs was maximized when the feeder gap allowed for 40% of the trough to be covered with feed. This improved feed intake resulting in improved growth performance. Previous research at PSC had already shown that for every 1 kg improvement in weight at 11 weeks of age, body weight at 17 weeks of age improved 1.5-1.8 kg. The optimum economics favours monitoring the feeder gap and reduced pig density approaching 3.75 square feet per pig in the nursery. (PSC Annual Research Report 2000, pg 14).

8. Pigs require, by weight, approximately 2.5 times more water than feed each day. Previous tests have confirmed that up to 40% of this water when delivered through a water nipple is wasted. Getting that water to the pig can be done through nipples, bowls or in the feeder. The choice of delivery method and how it is maintained can have a significant impact on water usage and the cost of delivering water and hauling away spilled water as slurry. The most common delivery device is the water nipple. Adjusting the height of the nipple to meet the needs of the pig has been shown to reduce water wastage from 10-20%. Water wastage increased about 7% when flow rates were increased. Assuming all the wasted water is eventually moved as slurry, this could be costing $0.25-0.60 per pig marketed. Nipples should be adjusted to 2.5 cm above the shoulder of the pig. (PSC Annual Research Report 2000, page 32; PSC Annual Research Report 2001, page 22).

9. Do not keep the pigs too warm. Elevated barn temperatures reduce feed intake and thus growth rate, and this can occur in the winter as well as the summer months. For every 1°C increase above the pig's thermoneutral zone, feed intake drops 1-2%, and growth rate drops about 3%. In the winter this cost is compounded with increased energy costs to heat the barn. The benefit to reducing temperatures will be a minimum of $0.50/pig for growth and $1.00+ per pig depending on energy costs. As spring and summer temperatures rise, watch your ventilation systems ability to adjust. Indoor temperature should be within 3°C of outside temperature. If the differential is greater than this the ventilation system is likely operating below an acceptable standard. Temperature recommendations are included in Pork Production Reference Guide 2000, pgs 42-46, or Swine Building Ventilation, pgs 64 & 65.

10. Controllers and sensors need calibrating and monitoring to ensure they are operating properly. Based on typical January conditions in the Saskatoon area, we have modeled the impact of having an improper setting allowing a minimum ventilation rate above that required for moisture removal. For the typical 200 head finisher barn and a natural gas price of $0.031/kWh, the increased cost of a ventilation rate 10% over requirement is approximately $1.88 per day, or $0.01 per pig per day. Depending on the days to market this could mean additional costs of $0.90 to $1.00 per pig. Guidelines for winter ventilation rates are provided in Swine Building Ventilation, pg 42.

Greenhouse Gas and Odour Emissions from Pig Production Buildings, Manure Storage and Manure Treatment Facilities

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General background information on the issue of greenhouse gas (GHG) emissions from swine production systems was presented in a previous article (Greenhouse Gas Emissions from Swine Production Systems, Centred on Swine, Winter 2002, Vol. 9, No. 4). That same article also introduced the collaborative research project on the determination of benchmark data for GHG and odour emissions from swine production buildings, manure storage facilities and manure treatment facilities conducted by IRDA, PSCI, UL in Québec and U. of S. in Saskatchewan between 2001 and 2003. In this article, we summarize the GHG and odour emission results obtained during this study.

Swine Housing

Greenhouse gas and odour emissions from intensive swine housing gestation, farrowing, nursery and grower-finisher rooms were determined at both the PSC Floral and Elstow sites, in grower-finisher rooms with both partially and fully slatted floors at Elstow. Samples were collected once every season, for a total of seven samples over the study. Emissions were measured during each season during the two years of the study.

Table 1 presents GHG emissions from the two different swine housing sites. The most important contributor to GHG emissions from swine buildings was CO_2. On an animal mass basis, CH_4 emissions were much lower than CO_2 emissions, and N_2O production was found to be negligible. Even when CH_4 and N_2O emissions are expressed in terms of mass of CO_2-equivalent by considering their respective global warming potential (GWP), CO_2 emissions remain much larger than those for CH_4 and N_2O.

The lowest CO_2 production was measured in gestation rooms, and the largest was in grower-finisher rooms. As most of the CO_2 is produced by animal respiration, these results are to be expected and were consistent between both sites. In the same way, the floor design did not affect CO_2 production. However, the CH_4 production rate was higher with the fully slatted

Table 1. GHG emissions from different room types in two swine production buildings.

Room type	GHG emission (g/day-kgpig)			GHG emission – CO_2 equivalence (g CO_2 equivalent/day-kgpig)[1]		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
PSCI Floral site						
Farrowing	49.2	0.63	0.000	49	13	0
Gestation	21.0	0.27	0.000	21	6	0
Nursery	89.0	1.96	0.000	89	41	0
Grower-Finisher	144.5	0.14	0.002	145	3	1
PSC Elstow Research Farm Inc. site						
Farrowing	36.8	0.10	0.000	37	2	0
Gestation	26.9	0.07	0.000	27	1	0
Nursery	30.4	0.39	0.000	30	8	0
Grower-Finisher (Partially slatted floor)	90.5	0.24	0.000	90	5	0
Grower-Finisher (Fully slatted floor)	92.3	0.43	0.001	92	9	0

[1] 1 kg of CH_4 = 21 kg of CO_2-equivalent; 1 kg of N_2O = 310 kg of CO_2-equivalent

Greenhouse Gases

CO_2 - Carbon Dioxide
CH_4 - Methane
N_2O - Nitrious Oxide

Table 2. Odour emissions from different room types in two swine buildings.

Room type	Floor space allowance (m^2/pig)	Odour emission (O.U./s-m^2)	Total odour emission (O.U./s-room)
PSC Floral site			
Farrowing	10.05	2.8	200
Gestation	2.79	3.3	1195
Nursery	0.41	7.3	370
Grower-Finisher	1.08	2.1	168
PSC Elstow Research Farm Inc. site			
Farrowing	6.55	3.5	321
Gestation	2.45	3.8	3300
Nursery	0.36	5.6	597
Grower-Finisher (Partially slatted floor)	0.96	6.2	1558
Grower-Finisher (Fully slatted floor)	0.89	7.1	1769

Note: O.U. = odour concentration in odour units as determined by olfactometry.

floor room than with the partially slatted floor room. The larger contact area between the manure and the air likely promotes higher methane emissions.

The odour emissions from the various types of rooms are presented in Table 2. Nursery pigs at the PSC Floral site produced the highest odour emission per square metre followed by the grower-finisher rooms at the PSC Elstow Research Farm Inc. site. The nursery room at the Floral site is based on an older design where more manure accumulates on the floor compared to the nursery room at the Elstow site. However, the gestation room produced the largest volume of odour emissions. On a site basis, considering the number of grower-finisher rooms required with a farrow-to-finish production system, the grower-finisher rooms constituted the largest source of odours.

Manure Storage and Treatment Facilities

In Saskatchewan, GHG and odour emissions have been measured at three different commercial sites that make use of uncovered concrete tank (PSC Floral site), uncovered 2-cell earthen manure basin (EMB; 1 site) and covered 2-cell EMB (2 sites, including the PSC Elstow Research Farm Inc. site). Blown chopped straw was used to cover the EMB facilities at those two sites. One uncovered concrete tank and two manure treatment facilities were monitored in Québec. One of those treatment facilities uses the biofiltration principle and the other uses alternate periods of aerobic and anoxic phases. Both treatment systems use mechanical separation of the fresh manure and compost the solid by-product. Table 3 summarizes the GHG emission data collected at those different sites between 2001 and 2003.

Table 3. GHG emissions from manure storage facilities and treatment systems

Storage and treatments facilities	GHG emission g / day-m^2			
	CH_4	CO_2	N_2O	CO_2-equivalent
Uncovered EMB	80.8	264.9	0.0	1961.7
Covered EMB	4.7	109.7	0.0	208.4
Uncovered concrete tank (SK)	23.8	55.8	0.0	555.6
Uncovered concrete tank (QC)	33.9	65.1	0.0	777.0
Low aerated EMB	7.7	30.6	0.0	192.3
	g /day-m^3			
Bio-filtration	24.5	309.0	0.8	1056.0
Aerobic and anoxic manure treatment	6.8	312.5	0.1	495.6

Measured CH_4 and CO_2 emissions from the manure storage facilities were significant sources of GHG, while N_2O emissions were found to be negligible. The presence of a blown chopped straw cover on EMB facilities resulted in a significant reduction of GHG emissions, especially methane. The CO_2 emissions from the manure treatment facilities were very high because both systems use a high airflow. In contrast to storage, both manure treatments produced measurable N_2O emissions.

In addition, the following observations were made on the GHG emission data from manure storage facilities in Saskatchewan:

- The variability of GHG emission data was very high;
- On average, GHG emissions were lower during the daytime and higher during the night;
- On average, GHG emissions were highest during the summer and lowest during the spring seasons;
- Overall, average methane emissions (CO_2 equivalent) were four times larger than those of carbon dioxide, while nitrous oxide emissions were negligible.

Average odour emissions from uncovered manure storage facilities ranged from 6.4 (EMB) to 8.7 (concrete tank) odour units per second per square meter of manure storage surface area (i.e. O.U./s-m^2). The addition of a blown chopped straw cover over EMB facilities yielded an 83% reduction of odour emissions on average. The biofiltration treatment system produced more odour emissions (7.3 O.U./s-m^3) than the aerobic and anoxic treatment system (2.0 O.U./s-m^3).

Bottom Line

Benchmark data on greenhouse gas and odour emissions from intensive swine housing, manure storage and manure treatment facilities were collected during a 2-year period in Québec and in Saskatchewan to determine the relative importance of GHG emissions from swine production systems, and to provide a baseline against which to gauge the effectiveness of future GHG and odour reduction technologies. These and other similar assessments will also help to pinpoint the major contributing sources of GHG and odours produced by swine production, which will help to focus future research efforts to effectively reduce the emissions. This will be the focus of a future article.

What is the proper stall size for gestating sows?

Yuzhi Li, PhD., and Harold W. Gonyou, PhD.

Stalls remain the principal housing system for gestating sows in North America. The Canadian Code of Practice recommends that stall size should be increased for larger sows. However, this is rarely practiced on commercial farms and there is little information about the effect of stall size on gestation sows. On many commercial farms, large sows are kept in 55 cm (22") or 60 cm (24") wide stalls into their 6th parity or higher, at which time their productivity is known to decrease. Since wider stalls are costly, producers may choose to use the minimum width of stalls that maintain productivity, while meeting the basic requirements for animal welfare. However, this desired width of gestation stalls is not known. In the current study, we assessed the suitability of stall width by examining the relationships among sow size, stall width, and sow behaviour.

The experiment was conducted at the PSC Elstow facility, which is equipped with four widths of gestation stalls: 55 cm (22"), 60 cm (24"), 65 cm (26"), and 70 cm (28"). All stalls are 220 cm (88") long. After breeding, females were classified based on their parity (gilts and sows) and body weight as: gilts, <150 kg; small sows, <150 kg; medium sows, 200 ~ 230 kg; and, large sows, > 230 kg, and assigned to each stall width, with the exception that no gilts in 70 cm stalls. Once the animal was moved into its treatment stall, she remained there until farrowing. In total 95 animals

Fig. 1. The percentage of time sows spent with udder extended into the next stall while lying laterally at week 3 (A) and week 14 (B) of gestation.

Figure A

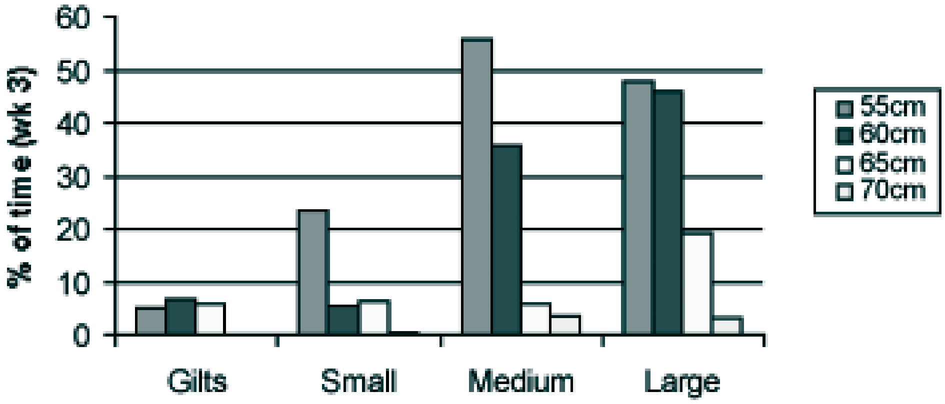
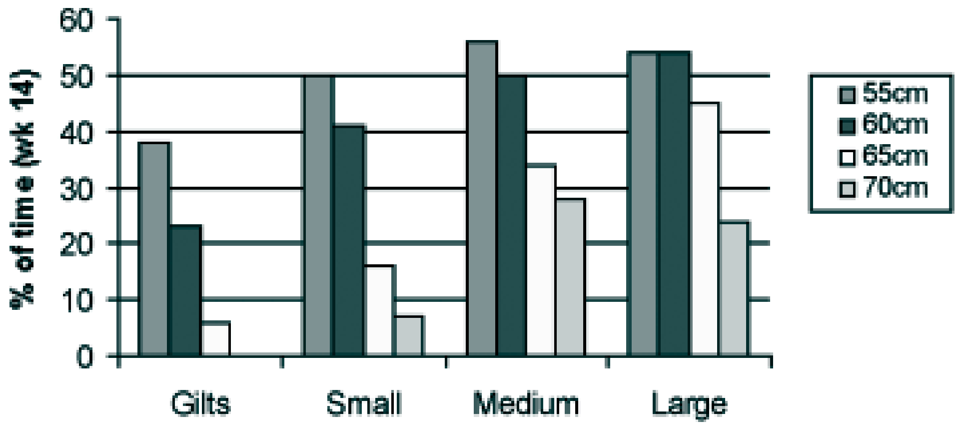


Figure B



were tested (19 gilts, 21 small sows, 17 medium sows, and 38 large sows). At week 3 and week 14 of gestation, a 24-h behavioural observation was conducted to determine sow postures and whether their udder extended into the next stall while lying laterally. The results indicate that the medium and large sows in 55 cm and 60 cm stalls spent more than 30% of their time with udder extended into the next stall while lying laterally at week 3 of gestation. The gilts and small sows at the same gestation stage in these stalls spent less than 20% of time with udder extended into the next stall while lying laterally. However, at 14 weeks of gestation the gilts and the small sows in 55 cm stalls spent 38% and 49% of their time, respectively, with udder

extended into the next stall.

It has been suggested that sows should be able to lie laterally without the udder extending into the next stall. If we used the criterion of less than 30% of their time with udder extended into the next stall to evaluate the stall width, we concluded that a 55 cm stall is only suitable for gilts and small sows at the early stage of gestation (wk3), but not wide enough for those animals at the late stage of gestation (Fig. 1). For sows larger than the medium size, 60 cm stall is not wide enough even at the early stage of gestation.

The Bottom Line

The results suggest that gilts and small size sows could be housed in 60 cm stalls, but medium and large sows should be housed in 65 cm or 70 cm stalls. From a practical point of view, if different sizes of stalls are not desired in gestation barns, 65 cm stalls would be recommended to accommodate all sizes of gestating gilts and sows.

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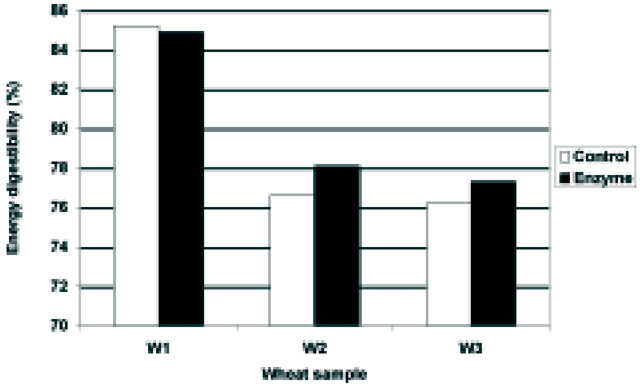

Figure 2. Improvements in energy digestibility were realized using enzyme supplementation for two out of three wheat samples. High quality wheat did not respond to enzyme supplementation.

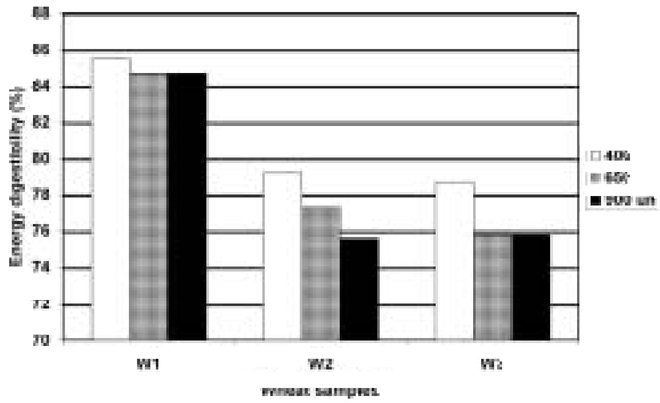

Figure 3. Improvements in energy digestibility for two out of three wheat samples using particle size reduction from 900 to 400 mm (microns) by grinding more finely on a hammermill. High quality wheat did not respond to particle size reduction.

and that an increase in fibre (NDF) coincides with a decrease in energy digestibility and DE content. The range in wheat DE content also reflects a range in economic value of more than $15 per tonne of wheat used for swine feed.

Enzyme Supplementation

Wheat diets were supplemented with a carbohydrase enzyme (xylanase). The enzyme should help the pig to digest energy, because negative effects of fibre fractions (or arabinoxylans) on energy digestibility will be alleviated. Indeed, enzyme supplementation improved energy digestibility for wheat samples W2 and W3, but not for wheat sample W1 (Figure 2), indicating that the beneficial effect of enzymes is dependent on the wheat sample in the diet. This result further stresses the importance of ingredient evaluation, or the importance of enzyme supplementation to alleviate expected differences in energy digestibility. The underlying reason for the positive response for W2 and W3 to enzyme supplementation and the lack of response for W1 is related to the content of fibre fractions in the wheat, specifically the fraction called xylan. Therefore, the wheat samples are presently being analysed for these fractions in an effort to predict enzyme response.

Particle Size

Wheat samples were ground across three hammer mill screens to achieve a predicted particle size of 900, 650, and 400 mm (microns). Particle size reduction should help the pig to digest energy, because a finer particle size means that the ratio of surface area to volume of the particles is increased. In other words, digestive enzymes and microbes of the pig have better access to the nutrients with a finer particle size. Indeed, reduced particle size improved energy digestibility for wheat samples W2 and W3, but not for wheat sample W1 (Figure 3), indicating that the beneficial effect of particle size reduction is dependent on the wheat sample in the diet.

The Bottom Line

Low quality wheat has a higher fibre content and lower energy digestibility than high quality wheat fed to grower pigs. The reduction in energy digestibility can be partially overcome by enzyme supplementation or particle size reduction. Ingredient evaluation is important to maximize the benefits of enzyme supplementation or ingredient processing.

Personal Profile

Dr. Augustine Owusu-Asiedu

Dr. Augustine Owusu-Asiedu joined the Prairie Swine Centre staff a year ago as a post-doctoral fellow in the nutrition group working with Dr. Ruurd Zijlstra. Augustine received his M.Sc and Ph.D. degrees from the University of Manitoba, specializing in Swine Nutrition & Immunology. His Ph.D. dissertation was designed to control the pathogenecity of enterotoxigenic Escherichia coli and improving performance of early-weaned pigs, using specific antibody obtained from the yolk of laying hens hyper-immunized Escherichia coli fimbriae antigen. This unique research has considerable scientific and economic importance due to the fact that the use of antimicrobial agents is being restricted due to concerns of multi drug resistance and strict quality control on farms to prevent residues in meat.

At the Prairie Swine Centre, Augustine is involved in applied research aimed at improving the nutritive value of low quality ingredients for swine. Development of experimental protocols, experimental design, data analyses, preparation of reports and extension articles, as well as articles for scientific journals are some of his responsibilities.

Dr. Augustine Owusu-Asiedu

Augustine began working with the Contract Research group in January 2004. He now ensures that the Prairie Swine Centre Inc. meets its objectives in providing contract research services to the private sector.

Coming Events

Alberta Pork Congress
The Westerner
Red Deer, Alberta
March 17-18, 2004

Focus on the Future Conference
Red Deer Lodge
Red Deer, Alberta
March 30-31, 2004

Western Canadian Livestock Expo
Prairieland Park
Saskatoon, Saskatchewan
April 20-21, 2004

Pork Interpretive Gallery
To book a group tour or find out more call 1-866-PIG-TOUR

Focus on the Future Conference

March 30-31, 2004, Red Deer Lodge, Red Deer, Alberta

Tuesday, March 30, 2004

9:00 a.m.	Registration
10:15 a.m.	Opening Comments
10:30 a.m.	Surviving the Tough Times – John Patience and Lee Whittington, PSC
12:00 p.m.	Lunch
1:00 p.m.	Management in Alternative Sow Housing Systems – Harold Gonyou, PSC
1:45 p.m.	Immediate Opportunities to Reduce Input Costs in the Breeding Barn – George Foxcroft, Swine Research & Technology Centre
2:30 p.m.	Refreshment Break
3:00 p.m.	New Ideas in Discovering Profit in the Nursery – John Patience, PSC
3:45 p.m.	Driving Costs out of the Production System – Gary Dial, Greenleaf Management
4:45 p.m.	Closing Comments
5:30 – 7:30 p.m.	"Ask the Expert" Reception Don't miss this opportunity to talk one-on-one with some of the leading experts in the pork industry, regarding some of the challenges you face in today's pork production environment.

Wednesday, March 31, 2004

8:00 a.m.	Registration
8:45 a.m.	Opening Comments
9:00 a.m.	New Innovations in Manure Handling – Karen Stewart, PSC
9:30 a.m.	Identifying Factors Contributing to Ammonia Emissions – Erin Welford, PSC
10:00 a.m.	Refreshment Break
10:30 a.m.	"Driving the Bus - Canadian Swine Identification and Traceability" – Paul Hodgman, Alberta Pork
11:15 p.m.	Exploring Opportunities in Using Alternative Feedstuffs – Ruurd Zijlstra, PSC
12:00 p.m.	Conference Wrap-Up

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