# Proceedings

*of the*


## 11th LONDON SWINE CONFERENCE

# Exploring the Future

**Wednesday, March 30, 2011**
**Thursday, March 31, 2011**

London, Ontario

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PROCEEDINGS

*of the*

# LONDON SWINE CONFERENCE

## EXPLORING THE FUTURE

*Edited by*
J.H. Smith, B.M. DeVries, and G. Simpson

March 30th and 31st, 2011
London, Ontario
www.londonswineconference.ca

Proceedings of the London Swine Conference
Exploring the Future

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# BREAK-OUT SESSIONS

# CHAIR'S MESSAGE

The London Swine Conference committee endeavours to develop a conference agenda that is relevant to what is happening in the industry and still offer practical, real world experiences. This year we took that one step further and considered the issues that will face this industry beyond 2011. The theme, "Exploring the Future", reflects the program's goal of addressing topics including animal welfare, markets, technology, emerging diseases and barn design that will most certainly challenge our perceptions and influence our decisions.

Our lineup of speakers and sessions is designed to make you think, get engaged and discover new ways of doing business. The first day opens with "Regaining our Share", a look back at the Canadian swine industry over the last three years and moves into sessions entitled "Beyond the New Normal", "Adding Value" and "The Road Ahead" where attendees will be exposed to global and local perspectives from numerous experts in the field.

Determining the future of our industry is not an exact science, but we can take our lead from other countries, market indicators, consumer behaviour and, in some instances, history itself. Decision makers, production managers and stockpersons can all benefit from this conference program and hopefully walk away with a greater understanding of what will make their businesses thrive moving forward.

London Swine Conference is a joint effort of staff from Ontario Ministry of Agriculture and Rural Affairs (OMAFRA), Ontario Pork, University of Guelph, Ontario Pork Industry Council and of course the industry sponsorship that makes it possible.
This is a venue for attendees to network, dialogue and share ideas. Join us at the 2011 London Swine Conference and let us begin "Exploring the Future" together.

Stewart Cressman
Chair,
Steering Committee
2011 London Swine Conference

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# REGAINING OUR SHARE

# LESSONS, OPPORTUNITIES AND CHALLENGES

**Bob Hunsberger**
**Hog Producer**
**Conestoga Meats Packers, Wallenstein Feed & Supply**
**Breslau, ON N0B 1M0**
**E-mail: rhunsber@uoguelph.ca**

## BACKGROUND

In the last five years the economic pressure on hog producers has varied between mild and intense. There have been only a few months when the average returns for producers have been positive. Of course, there is wide variation in the cost of production among producers but very few have been profitable on the hog portions of their farm businesses. Additionally, the returns in the packing sector have been declining as well.

As a result of that pressure, producers have been searching for solutions. The suggestions have included the following.

a) Improve demand for pork, specifically in Ontario, by advertising campaigns that would emphasize *local* attributes and product quality. This is an appeal to national/provincial loyalty through labeling policies. Some anticipate that this would raise the demand, and therefore the price, by enough to return the industry to profitability.

b) Convince governments that society should help hog farmers by subsidies, although we would prefer to call them something other than ***subsidies.*** The logic is that as suppliers of food, producers need stability in their returns and that all of society will benefit from that. Generally in Ontario, Quebec is held out as the model for this type of system. Other countries, specifically the EU, have also used this tactic. This would almost certainly be subject to countervailing duties and reduce trade.

c) Restrict trade so that Ontario retailers are legally required to buy Ontario product and that cheap imported product from other countries or provinces should be outlawed. This proposal puts a legal twist on the local food story. Generally, economists and trade experts regard this as unachievable as it would significantly impact our existing trading agreements.

All of these, and more, have been tried many times by other segments of economies in many countries and over many years, even centuries. My objective is to discuss how we can learn from those previous experiences and suggest some possible course for the future.

## LESSONS LEARNED

### Currency Exchange Rates Matter

For the early part of Canada's history our exchange rate was fixed. It was tied to the American dollar (US$) which was in turn, tied to gold. The price of gold was $35 per ounce. Some of us (but not many) can remember when the Diefenbaker government, in the early 1960s, "devalued" the Canadian dollar (C$) from about $1.00 US to $0.92 US. The opposition was incensed and it cost Diefenbaker his majority government. It was a point of national pride. The opposition called the currency Diefendollars. From an economic standpoint however, it was probably the right thing to do.

From then until late 2007 the C$ was virtually always less than the US$. We thought that was normal and expected it to always be less. The rapid move in a few years from $0.65 US to par caught the whole Canadian economy by surprise.

The building investments and other capital expenditures made fifteen to twenty five years ago proved to be too high with the dollar at par. We over-capitalized the Canadian hog production segment of the pork industry.

In the long run, exchange rates follow economic productivity. In the last ten years the Canadian economic environment has been improving relative to the United States. The implementation of the GST in the late 1990s and the reduction of the Federal deficit as a percent of GDP set the stage for improving economic performance. Eventually the Federal deficit was turned into a surplus. The surplus persisted until 2009.

Now the Canadian corporate tax rate is lower than the American rate, although the U.S. has many loop-holes. Canada came through the 2008 economic crisis in better shape than most countries in the developed world. American financial writers have noticed. Canadian stocks are being recommended by many stock market newsletters. Financial papers, such as The Wall Street Journal, are noting that Canadian corporate tax rates are lower than American ones and our federal budget and deficit are a much smaller percentage of GDP.

> *"It wasn't long ago that Americans viewed Canada as a poorer neighbor with only one competitive advantage—in hockey. No more: On January 1, Ottawa cut the nation's corporate tax rate to 16.5% from 18%, compared to the U.S. federal rate of 35%.*
>
> *This isn't a new trend up north. Canada starting cutting corporate taxes in the 1990s under the Liberal government of Paul Martin and has since enjoyed a virtuous cycle of investment, job creation and growth. The trend has continued under Conservative Prime Minister Stephen Harper, who has pledged to take the rate to 15% by 2012."* (Wall Street Journal, January 4, 2011)

We should expect our currency to stay strong relative to the U.S. dollar for some time. This means that very high futures prices of $95-100/cwt will translate into approximately $165 - 175/ckg. In the "good old days" those futures prices would have resulted in record high Canadian prices of $250/ckg.

**Culture, Customs and Values Matter**

The per capita pork consumption is declining in Canada and in the U.S. The slippage may be greater in Canada where per capita annual consumption is now less than 20 kilograms. Several factors are applying downward pressure. These include:

a) Trends toward vegetarianism for a variety of reasons. Sometimes those reasons are based on nutritional perceptions, sometimes they're based on environmental interpretations and sometimes they're just taste and personal preference.

b) Generally accepted medical opinions are that we eat too much red meat. Dr Oz, the latest Oprah protégé, has recommended that "a good way to control your weight is to have meatless lunches".

c) Concerns about animal welfare that specify how animals should be housed and cared for. Sow stalls take the brunt of the criticism but many other animal housing and handling practices are being questioned. There will be more to come.

d) Religious dietary restrictions. As the percentage of Muslims in the Canadian population increases, the per capita pork consumption can be expected to decrease. Some will argue this is offset by a rising percentage of immigrants from Asia, where pork is a preferred meat.

e) Perceived food safety issues with mass production systems. Our society is very risk averse. Any perceived risk will turn some people away.

f) Substitutes will become increasingly common. Tissue culturing of meat is here. Scientists know how to do it but it is not yet cost effective. That part may come sooner that we think. In addition, vegetable based meat replacements are consistently more widely available.

As people involved with food animal production we tend to discount these issues. However, meat/pork is not essential for human health and there is a chance that these *social cause* based perceptions will become more common. On February 1, 2011 the Oprah show ran an episode called Vegan For A Week. They took their cameras into a Cargill beef plant and the bottom line message was:

> *"It's ok to eat meat if you choose to, but limit your consumption* (one guest suggested twice a week) *and choose meat from ethical small farmers."*

Animal welfare is an implied, if not explicit, factor in the arguments against meat. This is an important area for our industry to address. We need an animal welfare marketing campaign to support and supplement the excellent work already being done.

Mahatma Gandhi, the master of social cause based fights, said this: "First they ignore you, then they laugh at you, then they fight you, then you win". It is possible that the reduction of red meat consumption will continue as the beliefs of a few become more widely accepted in North American society.

We need to recognize that more people may question our processes and products and use moral and ethical arguments to justify their positions. We're still ignoring and laughing.

**Access to Markets Matters**

Canada is a rich country. We have a small population and a large land area with plentiful resources. We have a good arable land base, a desirable climate for pig production and a plentiful supply of fresh water. We can, and do, produce more pork than we can eat and there are parts of the pig that we don't want to eat, but other people do. We represent a small portion of global pork production. Canada contains about 1.7% of the world's pigs and 0.5% of the world's people. We need to trade in pork products. We should expect our governments to assist with that.

In the past, we have not been aggressive traders and we have not focused our infrastructure on enhancing trade. In her book, 'Why Mexicans Don't Drink Molson', Andrea Mandel-Campbell (2007) goes into great detail about the difference between actively pursuing markets abroad and simply taking orders. She makes the point that Canadians have been order takers more than marketers.

One agricultural sector that is acutely aware of the importance of market access is the cotton industry and we can learn from that experience. It has always been dependent on exports, global processes and markets. For a complete history and description of that evolution over the last 200 years, I recommend 'The Travels of a T-Shirt in the Global Economy' by Pietra Rivoli (2009).

Some think that environmental concerns will reduce trade because of the transportation cost and impact. However, the energy consumed by a T-shirt in its life is reduced by 60% with the consumer choice to use a clothes line instead of a dryer and reduced washer temperature. The energy used per kilogram of pork consumed is heavily weighted towards the home. Global transportation is very efficient and getting better. It is cheaper than ever before in human history.

## CHALLENGES AND OPPORTUNITIES AHEAD

Canadian hog producers face a future with a strong currency, shrinking domestic demand and rising global demand. However, the global market place is full of barriers and political whims. The U.S. market is the most accessible for us. It is still the biggest and richest market in the

world but is subject to the same negative pressures as the domestic market. Still, it is our major export market and we should not neglect it.

**Increasing Global Demand**

As global incomes rise more people will eat more meat. This is particularly true in Asia and specifically in China. This represents a big opportunity for a country like Canada. We can produce pork cheaply and efficiently and will be well positioned to increase our global market share.

This year the world population will reach seven billion. Many of those people will be in rising economies, such as China. As their incomes rise, they will want to eat more meat. In most Asian societies, pork is a preferred meat. Also in Asian countries, Canada is well regarded as a reputable supplier with a good handle on technology and food safety. We have not done a good enough job of protecting and enhancing our reputation.

> *"The World Bank has predicted that by 2030 more than a billion people in developing countries will belong to the "global middle class", up from just 400 million in 2005."* (Kunzig, 2007)

What will it take for Canada to capture a desirable share of the increasing global market? It will take trade and innovation. We need to do a better job of both.

It is likely that the global demand for pork will grow in the next 20 years, but it is possible, maybe even probable, that the North American pork demand will continue to decline. That is definitely a challenging situation and it demands more trade expertise.

**Thinking Competitively**

Canadians usually think of themselves as being less competitive than the U.S. We have long pictured ourselves as being incapable of producing as cheaply as the Americans. This is not the case, particularly on the farm side. Since mid-year 2010, the corn price in Ontario has been lower than in Iowa and it has consistently been lower than in North Carolina.

The packing side is a different story. American plants generate more revenue per hog and have lower plant operating costs. Contrary to popular producer opinion, the hog procurement cost is similar in both countries. We need to actively work to reduce packing plant costs in Canada. It will take actions by individual firms, governments and industry organizations to make it happen. Building a more competitive packing sector is a challenge for our industry.

In 1900 Wilfred Laurier predicted that "this will be Canada's century". While we did well in the 1900s we didn't perform as Laurier had anticipated. We also didn't do what he said was necessary for the dream to be realized. Among his prerequisites were limited government size with light taxes and fiscal discipline. Additionally he was a strong promoter of free trade with the Americans. We haven't, until recently, done very well on these issues. As mentioned

though, we're improving. 'The Canadian Century' by Brian Lee Crowley et al. (2010) provides an excellent summary of why the Canadian economy is currently the most stable of the G7 group

Many times in the last twenty years we've heard advisors and consultants tell us that we can't compete with the U.S. in commodity product and that we must differentiate ourselves in the markets. While most of us are in favor of differentiation, and the dream of having consumers ask for Canadian product brings warm feelings in our hearts, it is not likely to happen very often.

I don't buy into the idea that we can't compete. There's no fundamental difference between Southern Ontario and Michigan or Ohio. Too often we're swayed by the widely circulated and loudest opinions and fail to look at the facts.

The Canadian hog and pork sectors have been guilty of thinking in narrow silos, concerned about their own businesses or segments at the expense of the entire supply chain. There are opportunities in working together and coordinating efforts. One example of this is carcass weights. It's pretty clear that both farmers and packers profit from heavier hogs and in the last 40 years we've moved from selling 200 pound pigs to 275 pound pigs. With each increase we've heard complaints that the packers were disregarding the interests of farmers and/or consumers for their own benefit. With each increase we have dragged slowly and reluctantly behind the Americans. We could have been leading in this area.

A major contributor to competitive production is technological development. Sometimes we hear people say that we've become as efficient as we can possibly be. This is never true. Look at the technological advances in hog production in the last 50 years. Sow productivity, feed efficiency and carcass quality have all improved dramatically.

Think about corn yields over the last 50 years. Many Ontario farmers now expect 200 bushels per acre and it's possible that we'll soon see 300 bushels. For a description of the impact of agricultural technology on our society see 'The Rational Optimist' by Matt Ridley (2010).

The challenge is to build our industry. Be big enough to be competitive, but nimble enough to be special.

## CONCLUSIONS

The hog and pork businesses are becoming increasingly competitive but Canada is well positioned to maintain its position in the global market place. We must become competitive with our dollar at par with the U.S. dollar. That's a bigger challenge for meat packers than for hog farmers but both must improve.

The actions we take can determine whether the industry prospers or dwindles. There is no certainty that hog production and processing can continue to be a significant portion of Canadian agriculture. The prominence of hogs and pork in Canadian agriculture and the global positioning of Canadian pork, depends on us. It depends on our ability to produce our pork products

competitively and market them effectively in international markets. It's hard work with no guarantees of success.

Ontario and Canada need to foster a spirit of innovation and creativity in order to gain and maintain global market share. A small percentage gain in global market share is a major increase in Canadian production.

Technological advances will continue to pressure and assist the economy. This will apply to both the technologies of our own production and those of alternative sectors. Meat substitutes will be increasingly available at declining prices as the technologies improve.

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# DEMANDING CONSUMERS VS. CONVENTIONAL AGRICULTURE

**Mike A. Varley**
**BPEX (British Pig Executive)**
**Stoneleigh Park, Kenilworth, Warwickshire CV8 2TL UK**

## ABSTRACT

The European swine industries have evolved rapidly over the last 20 years and in many ways are more integrated than ever before with various export / import arrangements more complex than ever before. The UK, for example, is only approximately 50% self-sufficient in pork products and imports the surplus from Denmark and the Netherlands amongst others. The Danish industry is 400% self-sufficient and exports all around the globe and also exports around 8 million weaner pigs into Germany and elsewhere in Europe for finishing. Despite all the integration, the various industries are also highly competitive. The UK industry has regressed significantly in the last 15 years but meets this intense competition now by creating a premium product. Animal welfare, marketing tools, and supply chain integration coupled with product differentiation allows the UK industry to maintain a significant price premium over mainland Europe. This has also been aided by the currency differentials across the European Union. European and UK consumers are therefore becoming ever more sophisticated and demanding in their pork purchases. They are well aware of issues to do with animal welfare and product safety. They are also aware of pork provenance and place a high ranking for UK produce.

## INTRODUCTION

The UK swine industry has gone through and survived some very turbulent times indeed over the last 10 years or so. In addition to the global crisis in 1997-98 when pork prices were only half the costs of production for a time, we have incurred significant challenges due to notifiable diseases (FMD, CSF) and Post Weaning Multi-Systemic Wasting Syndrome. This has all been in the framework of constant intense competition within the EU to supply our own internal market in the UK. We are still around 50% self-sufficient in pork products in the UK and most of the imports stem from Denmark and The Netherlands.

## THE UK PIG INDUSTRY

The UK industry has regressed from around 750,000 sows in 1995 to its present 450,000 sows but the businesses comprising our industry are stronger, resourceful and expressing real professionalism because of the lessons learned. Our current Minister of Agriculture summed this up recently by declaring that the UK industry actually produces the same volume of pig meat now as we did in the mid 1950s ***but with only half the number of sows***! We have hence demonstrated a high level of knowledge transfer in this progression and we have put our own well developed research programmes to good use and wide application.

Accordingly we have just enjoyed two years of the best trading conditions in the UK in the last 30 years. High and sustained pig prices at the farm gate and enhanced demand from supermarkets and consumers has been coupled with relatively low raw material costs. This has allowed our swine producers to take a breather and take stock of their businesses. We have seen business re-investment in new farms in some cases but also investment in new and re-furbished buildings. We have seen investment in training and recruitment of new staff for the industry and we have seen renewed interest in technology for the future. Right now of course with high cereal and protein prices this situation is getting a bit more problematic again for producers.

## UK PREMIUM PRODUCTS

One of the principal reasons why we have been able to secure our position is that we have demonstrated to our consumers that we have a premium product. This is recognised by the multiple retailing supermarket chains and there are only around six of these very large companies that serve the whole UK market so they command very great buying power in the UK meat markets.

This premium position has also been undoubtedly helped by the fact that the UK did not join the ***Euroland*** area within the EU with the Euro as currency. We remained with our British pound sterling and because of the relative weakness in the last two years of the pound to the Euro this has also made it far less attractive for processors to import large volumes of pork products from overseas. All of this has given us for the last two years a premium price advantage of around 30 Eurocents per kilogram deadweight over European competition.

The price premium also works because we have been able to very clearly ***differentiate*** our product from overseas competition including the Danes and the Dutch producers. In the UK we have about 40% of our breeding herd in outdoor production farms which in addition to low capital requirement (arguable) compared to indoor systems, the former are highly preferred by consumer groups, supermarkets and welfare lobby groups.

Even though piglets are mostly transferred to conventional indoor finishing systems at either 8 kg or 30 kg the perception is still that ‘pigs are produced outdoors’! The supermarkets also have lost no opportunity to market heavily on this and many have ‘outdoor produced pork’ premium lines with heavy marketing and visibility in the stores. It seems likely that consumers are confused by all the various categories of budget lines, premium lines, outdoor reared and outdoor bred and all through to genuine organic production. Recently in fact we have seen more clear, legal description of some of these categories via the BPEX Marketing Department that hopefully will reduce the confusion and help consumers to understand their purchases.

## UK INDUSTRY SUPPORT BODIES

The UK industry has also been well served by its representative bodies through these turbulent times. In 1998 we saw the formation of the BPISG, The British Pig Industry Support Group – a group of highly committed and able pig producers who operated very effective campaigns

against imported products and were often picketing and closing the supermarkets who were seen as the targets and who were major importers of cheap 'inferior' product.

The BPISG eventually evolved into what is now our NPA (National Pig Association) a group representing politically the pig producers but also the wider industry. NPA also has an Allied Industry Group consisting of the genetics, nutrition and building companies serving the pig industry. NPA has been very effective in placing the pig industry's agenda firmly on the top of the government's agenda and keeping our aims and objectives moving. NPA actually works very closely with BPEX which is charged with the development and transfer of new knowledge (research and development), marketing and also market intelligence for the benefit of the industry. BPEX Marketing has also been highly effective for the industry in developing and selling to the general public the UK so-called 'Red Tractor' logo. This is the quality mark used by almost all the supermarket chains that is placed clearly on labels to designate that meat product packs have emanated from production systems that are approved and regulated by our national systems for Food Quality Assurance. We have 2 major companies that deliver QA for the pig industry (Assured British Meats and Genesis). The Red Tractor is known and recognised by consumers widely. Over and above this is our RSPCA Standard known as Freedom Foods and this is also understood by consumers and supermarkets. Basically the outdoor producers who breed and rear outdoors are almost automatically eligible for this standard because they do not use farrowing crates.

## PRODUCT DIFFERENTIATION

Product differentiation has therefore been highly successful in recent years and we have tried to exploit our competitive advantages in this regard but we are always aware that our competitors continue to take up some of the same methodologies.

The outdoor breeding farms have certainly been a major driver in our development and progress but also when it comes to the other 60% of farms in the UK, we have no individual dry sow stalls or tether systems nowadays. The EU will basically ban these in 2013 but the UK took a difficult decision back in 2000 to ban them at that time. When this happened there was a large objection from producers and some farmers disappeared from the industry at that time also. Those farmers who remained in production installed group housed systems and many put in ESFs (Electronic Sow Feeders). Despite early teething problems these systems now work very well indeed and because much of our swine production is in Eastern England where there are large cereal growing farms and a good supply of straw, the use of straw bedding was cheap and easy.

I strongly suspect now that most producers would not return to individual stall or tether systems and the production KPIs (Key Performance Indicators) show that with group housing there is no significant fall in production.

In addition to the breeding herds, the UK also operates a large proportion of its finishing units in Eastern England and again straw based systems are evident. We also apply with a high degree of compliance other EU rules on welfare including stocking density regulations, application of

manipulable materials (bedding or straw), mutilations (teeth clipping / tail docking), and also the EU regulation on the minimum weaning age (28 days). Many other European countries do not attain the same level of compliance although it should be said that the tail docking ban is the most contentious.

## REAL WELFARE PROGRAMME

One of the problems in animal welfare is in its evaluation and description. In many ways we have focussed mostly on what we tend to refer to as resource-based welfare. That is we judge a system on its physical attributes such as use of bedding, good health status, small group size and stocking densities and so on. Real welfare not only incorporates these physical attributes of a farm or system but also the real measures on the animals themselves. In theory we could measure immune functions or reproductive functions and the incidence of aversive or other behaviours such as stereotypies and we could also use KPIs as welfare indicators. This has been the subject of very comprehensive scientific scrutiny and debate. It is, of course, not practical at all to make extensive measures of this kind on many animals and many farms.

What is possible however is to search out 'iceberg indicators' that act as very good correlates with the measures cited above. The iceberg indicators are easy and cheap to measure and represent from the tip of the iceberg the huge array of meaningful hidden measures that exist 'under the water'. This has been the subject of a €28 million EU research project (Welfare Quality) with most European countries involved. The UK took part in this study project and also undertook a further programme (Welfare Outcomes) to simplify for the pig industry the measures that could be used in an industry wide programme. The University of Bristol were the principal contractors in this work. What transpired out of this initial work was that five relatively simple measures could be taken on a sample of pigs at a particular time by a trained veterinarian or quality assurance officer. These could provide a snapshot of the welfare status of that farm at that time. By making repeat measures through the year a clear index of the status of the farm is arrived at.

It has to be said that there was initial reluctance on the part of producers to get involved in this and also the veterinarians involved. However with careful publicity and public relations we have now moved into stage 2 of the programme with around 250 farms involved and the total commitment of the veterinarians and most of the farmers.

The 5 measures will be:

1. Body lesion score
2. Tail lesion score
3. Lameness score
4. Manipulable material score
5. Hospitalisation score

These scores are carried out very systematically and based on the previous science based evidence compiled in the stage 1 part of the programme.

The hope is therefore to provide a demonstration of the very good standing of the UK industry in terms of animal welfare. We have wide use nowadays of stockperson and management training and welfare is an integral component of these courses. The stage 2 element of the programme will provide a very good database from which to fine tune our measures before a national roll-out of the programme thereafter. BPEX have been publishing the programme details in our national farming press to explain to producers and the industry at large what we are aiming to achieve out of the work. The QA companies are very committed and positive to the programme and Freedom Foods are also establishing a concurrent programme with almost identical measures to the BPEX programme.

## CONCLUSIONS

Product differentiation for the UK swine production industry is now a key component of our current array of business targets. We have had some success on this front in recent years but this could be quickly eroded as our competitors watch and learn. We have learned some valuable lessons along the way. Firstly, we now understand the power of an integrated supply chain. We may never have the same level of large completely integrated companies as in North America but we now have the formation of some of our largest swine production companies working in contractual arrangements with processors, retail outlets, feed companies and genetics companies. These appear to be working well and we may well see more of this type of production in the future. Our largest company of this type is actually owned by Danish Crown along with the processing company itself. I would anticipate significantly more pan-European connections of this type in the future.

Secondly, if we are to maintain our differential and product premium we must strive to keep ahead. We are working hard on our national health status for the pig industry and we are also heavily committed to our agreed environmental targets for the near future in terms of GHG (greenhouse gas) emissions and C (carbon) equivalents. We are in good shape also in this regard yet we will still meet our set targets for 2020 and 2050 which ultimately demands an 80% reduction in C equivalents by this time. Pork meat has a very low C output when compared with the ruminant industries and in the UK pork still sells for around 30-40% of the price of beef.

Finally we are also seeing modest revival now in the UK in farm to fork businesses producing their own pigs and then branding and retailing their own produce via local outlets such as the high quality premium butchers. Some of these are having real success in this endeavour and there is no doubt that this type of carefully produced and selected product delivers an eating quality that is very hard to beat.

# BEYOND THE NEW NORMAL

# A REVOLUTION IN PORK PRODUCTION

**Augusto Heck**
**Swine Specialist**
**BrasilFood's Corporative Office**
**39 Saul Brandalise St., Downtown Videira, SC, Brazil 89.560-000**
**E-mail: augusto.heck@brasilfoods.com**

## ABSTRACT

A series of non-technological factors such as the prevailing climate, water availability, land availability, density of pigs per area and cost of labor favored Brazil in the competitive landscape of pork production. Among technological factors we can cite the chain organization, which is growing, changes in the type of production, knowledge acquired and adopted, productivity of the grains that are raw materials, genetics used, negative status for Porcine Respiratory and Reproductive Syndrome, availability and use of ractopamine and immunocastration. Access to capital and positive Foot and Mouth Disease status are strong limiting factors for Brazil's Pork Industry to achieve premium markets. Among future likely consequences exists the possibility that Brazil, along with the United States, will polarize the leadership of pig production world-wide in volume. That could force traditional pork producers like Canada and Mexico to find new alternatives for their production like high added value cuts and niche markets. Differences between nations that export pork will persist in the near future. There will be a great demand for animal protein. The market share will change periodically. We also need to start to think about competing with beef and chicken, which may become in the future, real pork chain enemies.

## INTRODUCTION

Brazilian swine production is experiencing a change of position in international trade in recent years, from a mere adjunct to a great player. Several factors have contributed to it. The purpose of this review is to comment on some of the non-technological, technological, and limiting factors involved in this process and the likely consequences of it coming, which will probably impact on the swine industry in North America.

## NON-TECHNOLOGICAL FACTORS

### Climate

Differences between Brazil and the North American continent make producers and farm staff prioritize differently the management of the environment. The facilities in Brazil are almost entirely naturally ventilated without the need for artificial lighting (Piva, 2007). Also, the climate provides for the practice of two crops per year of corn and soybeans, which are the basis of the diet of pigs in the country (Wikipedia a).

## Water

Our planet consists of 71% water and 29% land. However, 97.24% of the water is salted water (oceans) and cannot be drunk by man or animals, as it is. Fresh water is just 2.76% of the remaining water in the planet. However, not all of it is available, as 2.14% is in the glaciers. What is left, and this is not much, is water stored underground (0.61%), and in rivers, lakes, moisture in the soil and in the atmosphere (0.01%). There are a few countries which have the privilege of having abundant fresh water. Thus, water availability is an essential and limiting factor to pig production. Regions with higher water availability have better conditions of producing, not only swine, but also other raw materials, like grains, essential to their feeding (Roppa, 2008). Brazil also has more water. According to the United Nation's World Water Assessment Report of 2009, Brazil has more than 8,000 billion cubic kilometres of renewable water each year, easily more than any other country. Brazil alone (population: 190 million) has as much renewable water as the whole of Asia (population: 4 billion). And again, this is not mainly because of the Amazon. Piauí is one of the country's driest areas but still gets a third more water than America's corn belt (The Economist, 2010).

## Land

One of the greatest limitations for the growth of swine production is waste. A pig defecates the equivalent that 2.5 people do, and the use or storage of this waste is becoming a serious problem in large farms. One way of using waste is as fertilizer. Therefore, countries which have large extensions of land and adequate climate will have the advantage of using the waste as fertilizer in crops and of producing grains for feeding the pigs at a lower cost. When we look around our planet for available areas for grain crops, we can see that there are just a few, and decreasing every year (Roppa, 2008). Between now and 2050 the world's population will rise from 7 billion to 9 billion. Its income is likely to rise by more than that and the total urban population will roughly double, changing diets as well as overall demand because city dwellers tend to eat more meat. The United Nation's Food and Agriculture Organization (FAO) reckons grain output will have to rise by around half but meat output will have to double by 2050. This will be hard to achieve because, in the past decade, the growth in agricultural yields has stalled and water has become a greater constraint. By one estimate, only 40% of the increase in world grain output now comes from rises in yields and 60% comes from taking more land under cultivation. In the 1960s just a quarter came from more land and three-quarters came from higher yields. So the sort of food producer that will matter most in the next 40 years will be one that has boosted output a lot and looks capable of continuing to do so; one with land and water in reserve; one able to sustain a large cattle herd (it does not necessarily have to be efficient, but capable of improvement); one that is productive without massive state subsidies; and maybe one with lots of savannah. The biggest single agricultural failure in the world during past decades has been tropical Africa, and anything that might help Africans grow more food would be especially valuable. These features match with Brazil. Brazil has more spare farmland than any other country. The FAO puts its total potential arable land at over 400 million hectares; only 50 million is being used. Brazilian official figures put the available land somewhat lower, at 300 million hectares. Either way, it is a vast amount. On the FAO's figures, Brazil has as much spare farmland as the next two countries together (Russia and America). It is often accused of

leveling the rainforest to create its farms, but hardly any of this new land lies in Amazonia; most is cerrado (The Economist, 2010).

### Density

We can have a better understanding of the positive perspective of growth in swine production in Brazil by comparing with the characteristics of other countries. Brazil has only 4.0 pigs per square kilometer, compared for example to 37.2 for the European Economic Community's 27 pig producing countries, or 6.0 pigs per square kilometer for United States. Availability of land added with this low density clearly demonstrates the possibilities of pig production expansion (Roppa, 2008).

### Labor Costs

Low labor costs benefit the Brazilian industry both at the farm and the slaughter levels, making profit in the entire pork chain competitive with that in other major production countries (Weydmann and Foster, 2003). The gross annual wage in International dollars for Brazil, Canada, Mexico and United States is: 4,261.77; 16,710.00; 1,753.00; and 15,080.00; respectively (Wikipedia b).

## TECHNOLOGICAL FACTORS

### Chain Organization

The production of live pigs in Brazil is mainly performed in a system of integration between producers and companies and to a lesser extent, by independent producers. Integrated production used by private companies and cooperatives alike, follows different models of relationship between the producer and integrator, with the older traditional models and the most recent partnership, with or without the lending of livestock or other assets. In traditional model farmers have committed to sell the animals to the integrator and, if only finishing is performed, piglets must be acquired from a farm also integrated. Producers may or may not be animal owners and have freedom for purchase feed, genetics and technical assistance outside of the integration. In a partnership, pork producers come with the facilities and manpower and all the inputs, including feed, genetics, technical assistance, etc. are provided by the integrator. The producers are rewarded with values based on criteria established in the contract with the integrator. In general, agribusiness companies lead the integration and coordination of all operations of production and perform the animal slaughter, industrialization and commercialization of products (Miele and Waquil, 2007).

### Production Growth

Production growth is being supported by significant investments by local meat companies and international agribusiness conglomerates. Many of the major pork processors in Brazil are also poultry processors, which allow them to better utilize the infrastructure, customer relationships

and marketing expenditures. The industry is also highly integrated, with approximately 75% of production coming from integrated systems (Boal, 2008a).

**Production Shift**

Over the last five years Brazil pig meat production increased by 21.8%. Not all types of production have grown, however. Expansion of industrially produced pork grew by 36.7%, while subsistence production, which results in the excess entering the market, declined by 34.1%. This points to an increasing professionalization of the sector. Total slaughter in the country between 2004 and 2009 increased by 27.6%. Those that were carried out in compliance with the Ministry of Agriculture's Federal Inspection Service (SIF) grew by 38.4%, while those operating under other systems declined by 3.4%. Some industrial plants that operated with state certification now have federal certification. SIF-compliant slaughter now account for 83.1% of all pig meat produced, up from 77.7%, which gives a greater guarantee of the quality of Brazilian pork meat. Subsistence production fell to some 17% of the total. This area of production is not subject to traceability measures and so, with its gradual decline, the health risks to consumers in the country have also declined (Clements, 2010).

**Knowledge**

Much of the technical expertise fueling Brazil's rising pork production is being transferred from North America and Western Europe (Weydmann and Foster, 2003). As the industry matures, leaders communicate and travel outside the country more to learn from the experiences of other pig farms and industries. They seek out developing trends and significant advances in genetics, health, environment, animal husbandry, nutrition and pig flow (Piva, 2007).

**Productivity of Crops**

In addition to expanding the area being cultivated, Brazil has significantly increased the productivity of key raw materials for the production of pigs, which are soybeans and corn. For corn, Brazil's average yield, harvested in metric tons per hectare was 2.48 in 1999, 3.80 in 2010 and will be 4.30 in 2019. For soybeans, Brazil's average yield, harvested in metric tons per hectare was 2.41 in 1999, 2.84 in 2010 and will be 3.05 in 2019. The expansion of land used for agriculture associated with the increase in productivity of grains is generating a visible growth in the domestic availability of such raw materials (FAPRI 2010 U.S. and World Agricultural Outlook Database).

**Genetics**

Many of the leading providers of seed stock with greater global penetration have structure with farms having great-grandparents for providing animals in Brazil. The product offering consists of grandparents and breeding lines of male and female, available both in Brazil and in other countries, customizable locally on-demand or unique to the internal market. As these programs have, as a general rule, international scope, considering herds of various places under monitoring, the performance in various animal traits becomes identical or with a minimal gap

between countries. There are also breeding programs developed by government research entities or national private companies.

### Porcine Respiratory and Reproductive Syndrome (PRRS) Status

Although the disease is widespread in swine herds worldwide, as yet there are no reports of PRRS in Brazil. Diagnostic tests have been performed in Brazilian herds since 1995. Since 1997 the Brazilian importers adopted rigid rules for importing animals or semen, due to concerns in relation to risk of introduction of PRRS in Brazil. Fortunately importers, despite having completed their own quarantine protocols, acted correctly and on time to prevent the introduction of PRRS in Brazil as occurred in Chile, for example (Zanella, 2006).

### Ractopamine

Since its use was permitted in 1996 in Brazil ractopamine hydrochloride has been widely adopted by the intensive pig industry. The consistent benefits on the performance parameters in the field and in the slaughterhouse have sustained its use, considering different strategies varying doses and days of consumption. Currently there are four different providers for this tool. Doses vary from 5 to 10 parts per million and duration of use, 21 to 28 days in most cases.

### Immunocastration

Starting with its launch in 2007 several of the largest producers of pigs tested and are adopting immunocastration as a routine practice for a portion of production or all of the males at finishing phase. Besides the appeal of animal welfare, the tool confers benefits on livestock indicators and/ or improves yield of high value cuts at slaughterhouse.

## LIMITING FACTORS

### Capital

Access to capital is a requirement for any business. There are understandably huge disparities between the costs of capital across countries. A farmer in Brazil would be faced with a higher peso denominated interest rate when seeking finance for a new hog operation than an integrator in Canada, who would be able to finance a similar capital project at a much lower dollar denominated rate (Boal, 2008b). Using as base the interest rate of reference of national central banks, we have the following status: 11.25% for Brazil, 1.00% for Canada, 0.25% for the United States and 4.5% for Mexico. Brazil and Canada have a tendency to raise the interest rate (Global-Rates.com, 2011). Brazil has the bronze medal in the contest of the greatest interest in the world. The country has the third highest rate base on the planet. The first place is Venezuela, with interest at 18.10% per annum, and second place Pakistan, with 14%. Brazil becomes the first one if considering inflation. The difference is that in Venezuela and Pakistan, the inflation is much higher (CNEWS.com, 2011).

### Foot and Mouth Disease Status

Brazil, as a country, continues to struggle with disease constraints, particularly Foot and Mouth Disease, which in turn limits market access, particularly to the highly sought-after markets such as Western Europe and Japan. Brazil remains dependent on Russia for export sales, but the major packers are making a concerted effort to diversify their customer base and export higher valued products (Boal, 2008a).

## IMPLICATIONS FOR NORTH AMERICA

In a study based on a survey, 70 world pork business leaders, with representation from over 15 countries, were asked to rate their respective countries on three dimensions: Structural Factors; Social & Political; Production Cost for Competitiveness. For Structural Factors, issues involved the following topics: corn prices, land availability, labor efficiency, farm productivity, local demand for pork, modern processing industry and pork quality standards. For Political and Social Factors, issues involved the following topics: pork in country's food strategy, government subsidies, local food safety regulation, level of environmental laws, welfare and pressure and the country's animal disease control. For cost competitiveness, issues involved the following topics: level of cost of production, % feed cost / total cost and cost per sow in a new project (Bobadilla et al., 2010). Reflections about the main countries for Pork Production in North America will follow in the next paragraphs.

### Canada

Concerning Structural factors versus Political & Social Factors only Canada and Brazil are classified as with great competitiveness; both have more land available for growth and have high production efficiency. At the same time there are relatively large differences. Brazil has access to more competitive grains and there is a reduced pressure on production practices from animal welfare concerns. The Canadian industry exports about 50% of production, which enabled them to develop a program of safety of meat, a high international standard, together with higher requirements in terms of the quality of meat offered to the market. Both Brazil and Canada have lost some international competitiveness because of having strong exchange rates. This situation may change in the medium term, product of a necessary economic adjustment in the economy of Europe and China that finally further revalue more to the dollar against other currencies like the Real and Canadian Dollar. As an alternative Canada could do what the big players can not do, to be flexible and work for adding value to pork cuts that can not be developed in Brazil and United States. Moreover, attacking niche products that would be difficult to produce by big competitors could be another option (Bobadilla et al., 2010).

### United States

In the last ten years the United States has become the dominator of global exports of pork. The industry consolidation has led to an efficient vertical integration in all links. Production has managed to contain the challenges of animal health and increasing productivity gains has meant reducing production costs dramatically. Most processing plants that have a capacity larger than

10,000 pigs have specialized day and processes for value addition. The limits to growth are on the environmental side, where in states like North Carolina production continues to decline. On the welfare side, the trend tells that the cost of production will rise and will require further investment on adaptation of new production systems. The recent crisis of profitability of the industry determines the reduction of about 600,000 sows that will not recover easily. The target is to focus on productivity with the same or even fewer females. It is not ruled out further expansion of American companies producing in other markets such as Mexico or China. Clearly the United States and Brazil will dominate world trade in pig meat. The United States has learned that to achieve a price that involves profitability for the industry must be at least: (1) A supply of pork according to domestic demand and a volume of 20% for export, so thus avoiding over-production cycles; (2) A degree of promotion that will enhance export and good and lasting business relationships with its export destinations, such as Russia, China and South Korea (Bobadilla et al., 2010).

**Mexico**

The country has great advantages beyond access to United States grains, surface to expand the industry and low restrictions of animal welfare. The pig is the fourth choice in animal protein, poultry by far in the first place with over 30 kilos, 22 kilos per capita for eggs in the second place, third is beef with about 16-18 kilos and finally pork with a little over 16 kilos. In reviewing the state consumption we see that certain areas have twice the per capita consumption than the national average, which means a significant growth potential. The main barrier to competitiveness is the control and the prevention of diseases of high economic impact. This is where the sector has to work together with the authorities and incentive schemes to control and/ or eradicate certain diseases. The country has two poles of export, Sonora and Yucatán, that have access to major markets of the world's pork and other states could join when a program of effective disease control could be structured. Like Canada, Mexico could try to be flexible and work for adding value to pork cuts that cannot be developed in Brazil and United States, attacking niche products that would be difficult to produce for their big competitors. (Bobadilla et al., 2010).

## CONCLUSION

There are large differences between nations that export pork and this reality will persist in the near future. As the world's population will not stop growing and there is an expectation of reducing poverty by economic growth in developing countries, there will be a great demand for animal protein. The skills and limitations of each country will make the market share change periodically. Perhaps, in addition to having concerns with the dispute between the nations we also need to start to think about competing with beef and chicken, which may become in the future the real pork chain enemies.

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# MANAGING VOLATILITY

**Justin Roelofs**
**AgStar Financial Services, ACA**
**1921 Premier Dr, Mankato, MN 56001**

## INTRODUCTION

The past three years have been unprecedented times in terms of volatility and the effect it has had on producers' bottom lines. The impact has been felt in both the United States and Canada and caused the US industry losses in excess of $2 billion dollars. In 2010, the average cost of most producers was $140-$145 for a 270 lb. animal. Going forward, to raise that same animal at the same weight with current feed costs, it will cost an additional $25 per head. *For the U.S. swine industry, this is $2.7-2.8 billion in added costs.* This is true not only for pork, but for milk, beef, eggs, and broilers as well. In order to re-coop the additional costs, prices will have to increase 10-15%. Will consumers be willing to buy the same amount at higher levels? We don't know if we are writing history – again. With all this volatility we all ask ourselves a few basic questions.

How did we get here?
What can we do to mange through this volatility?

With grains now tied to the cost of oil, gone are the days of predictable costs of production. There was a time when the range of corn was consistently $2-$3 bushel and bean meal was $150-$250/ton (see Chart 1). Ever since 2008 the world of livestock production has changed for the foreseeable future. So how *do* we manage through this volatility?

## CRUSH MARGIN

In my opinion, the most important thing is understanding the cost of production and all the variables that may affect those costs. Understanding costs allows one to effectively target an acceptable return on the investment. What do I mean by targeting an acceptable return on investment? If a business can identify what is an acceptable return, they can formulate a plan, set marketing targets, and pull the trigger based on that plan. The most successful risk mangers understand their costs and have a plan in place that allows them to effectively manage risk.

There are many individual pieces of production which must be locked in to truly "Crush" a margin opportunity. In terms of US production corn, soybean meal, and DDGS make up the largest pieces of the pie, but by no means complete the pie.

## FEED COSTS

There are many strategies and techniques available to lock in the desired inputs for livestock production. These can vary based on the size of an operation, but the best thing a producer can do is work with a professional marketing consultant/broker to find the best options for their operation. Many small to medium size operations find that one of the most effective ways of managing the feed input risk is to reverse integrate into grain production and control the physical product. This, however, is by no means the only option for smaller producers.

The Chicago Mercantile Exchange provides a tool for both small and large producers. If one understands their basis risk, and how to manage that risk, this tool can be utilized to manage most of their feed cost risk. There are also many different options strategies available to put a ceiling on input costs that will give a producer some downside potential. Many of these same options are available to protect the revenue side of production. These options include utilizing puts to protect revenue and calls to protect against increasing feed costs. Many producers utilize both in an attempt to protect a minimum return and leave the door open for something better.

## OTHER FACTORS

The best long-term risk management strategy is efficient low cost production. If a company is not a student of every aspect of their business they will fail to achieve the most efficient processes and will not be a low-cost producer.

Producers need to remember to address interest rate, energy, and human resource risk as well. Other than locking in long-term interest rates there are ways to manage interest rate risk. I've seen companies use the Eurodollar future to hedge interest rate risk, as there is a correlation between rising LIBOR rates (London interbank offered rate) and the Eurodollar future. There are also ways to forward contract fuel needs as well as hedge those needs through the CME.

One risk that is sometimes overlooked is human resources. Employees will pick up on the stress showed by ownership. A well thought through plan can eliminate this stress factor and the negative impact it can have on production.

## EXTERNAL FACTORS

Producers need to remember to look at facts only and not rumors. You also need to understand how the strength of your currency and exports may affect supply and demand for your product.

## A LENDER'S NEEDS IN VOLATILE MARKETS

A lender needs to understand what a client's costs and risks are before they can begin to understand a company's strategies and hedge positions. Having your lender on calls with traders to help them understand your positions, costs, and risks will help expedite any requests you may

have for funding margin management strategies. Lenders need to see that a client's risk management principles are transparent and support the long-term goals of the company. Timely, useful reporting is a cornerstone of a good risk manager and a good relationship with your lender.

## OUTLOOK FOR 2011

In looking at the next twelve month futures, the average price is close to $90 per carcass cwt. This equates on a 205 lb. carcass to $184.50 a pig. There still is a profit of $10-$15 a head for most producers. Also, the basis on hogs has widened since September (see Chart 2). This will narrow the margin for producers. Processors are still making very good margins (see Chart 3) but producers need a little larger portion of the margins in order to be successful next year. Volatility is the norm for the foreseeable future. Improving – even little gains – in all aspects of your business will lead to success.


**Chart 1. Increase in variability in prices in feed grains.**

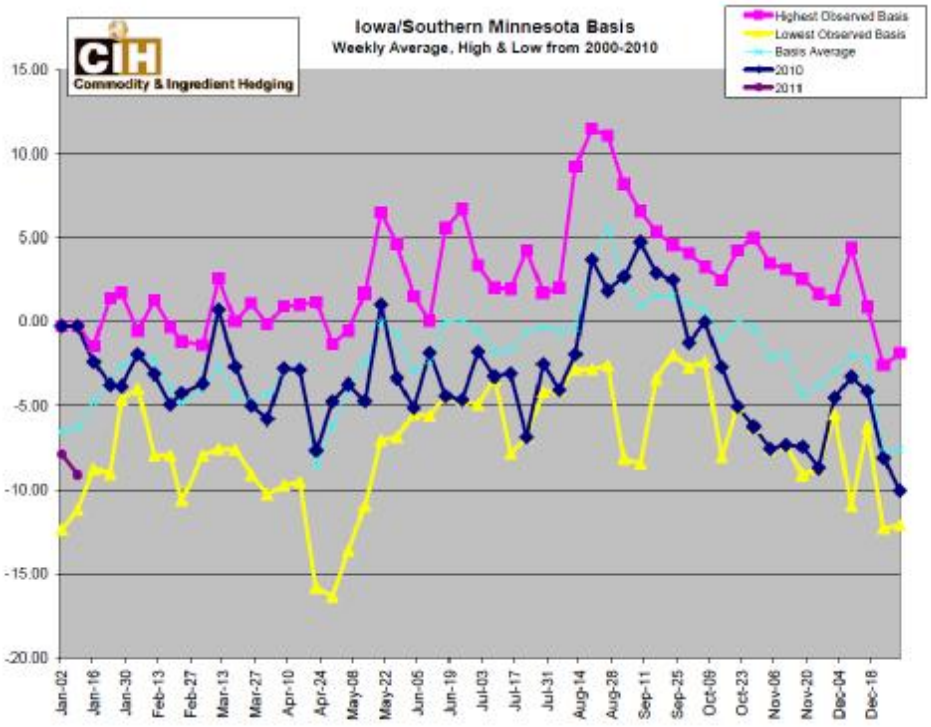


**Chart 2. Widening basis on hogs.**

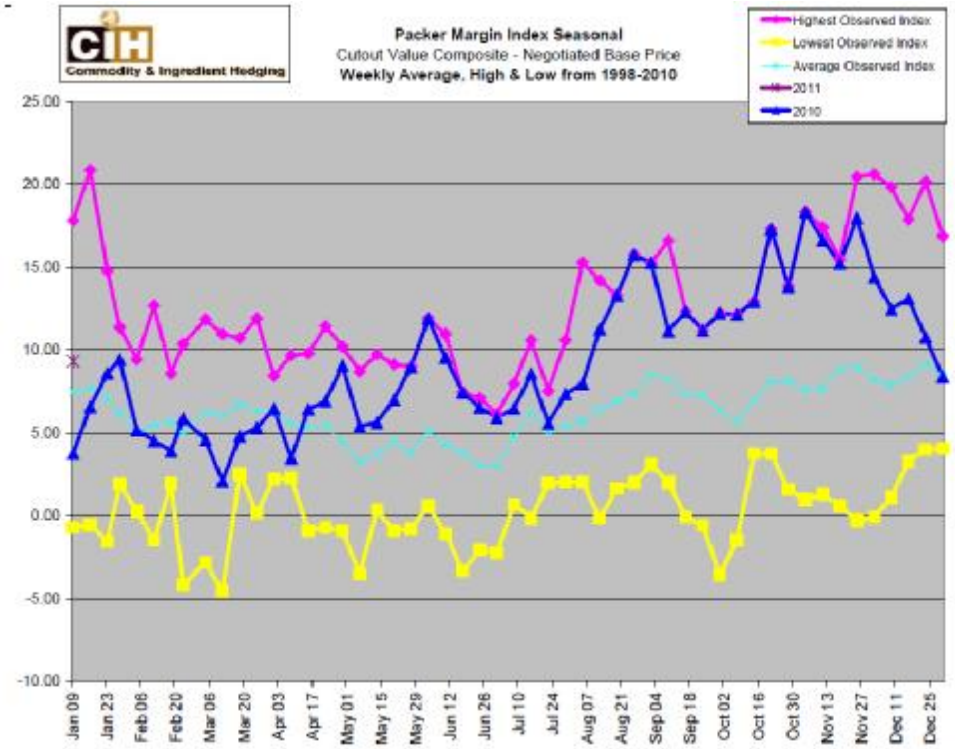


**Chart 3. Packer margins.**

# ADDING VALUE

# FAILURE TO THRIVE

**Alex Ramirez**
**Department of Veterinary Diagnostic and Production Animal Medicine**
**Iowa State University**
**2231 Lloyd Vet Med Center, Ames, Iowa, 50011**
**E-mail: ramireza@iastate.edu**

## ABSTRACT

Enteric diseases are some of the most significant contributors to baby pig morbidity and mortality in the farrowing house. Piglet immunity must be maximized in order to provide them with the opportunity to thrive in the farrowing house. The production of consistent, high quality pigs is a goal all sow operations are working to achieve. By maximizing piglet immunity and using proper husbandry practices, scouring problems can be minimized. *Escherichia coli*, clostridial diseases, rotavirus, and coccidiosis continue to be the major pathogens of concern in the pre-weaning period. Some things have changed over time while others continue to be the same. It is the goal of this paper to briefly review key concepts on maximizing piglet immunity as well as address some of the current trends in enteric pathogens in the farrowing house.

## INTRODUCTION

All sow farms have a common goal: produce a high quality piglet. This sounds like an easy task. There are a lot of great farms out there producing good quality pigs consistently. There are also many operations that continue to struggle year after year. Even in those operations where performance is great, there is always room for improvement. The goal of improvement is not always just to produce a high quality pig, but also to do that in the most consistent, efficient, and profitable way. Consistency is critical as it helps those who end up feeding these piglets out to market (slaughter or breeding stock sales). Efficiency is critical as farm labor availability is becoming more and more of an issue worldwide. Finally, profitability is of the utmost importance as ultimately it is the driving force for the existence of any industry.

Enteric diseases are some of the most significant contributors to baby pig morbidity and mortality in the farrowing house. The latest U.S. National Animal Health Monitoring System (NAHMS) Swine Report data from 2006 indicated that scours were identified as the third leading producer-identified cause of pre-weaning death accounting for 13.2% of deaths. Crushing by sow (42.0%) and starvation (29.7%) were the other two main causes reported. The top three causes of pre-weaning mortality are the exact same ones identified by Crooks et al. (1993) from the 1990 NAHMS National Swine Survey. It is the goal of this paper to briefly review key concepts on maximizing piglet immunity as well as address some of the current trends in enteric pathogens in the farrowing house. The goal is to provide relevant and practical tips that will help sow farms achieve a consistent goal of producing high quality pigs efficiently and profitably.

## MAXIMIZING PIGLET IMMUNITY

Weaning weight is considered one of the most important factors impacting post-weaning and lifetime growth performance (Lawlor et al., 2002). Piglet enteric problems in the farrowing house are a major contributor to poor performance. Before discussing farrowing house enteric pathogens and their consequences, it is important to start at the beginning. To maximize piglet survival, pigs must obtain sufficient, good quality colostrum in a timely manner.

### Colostrum

Pigs are not able to obtain antibodies from their mothers while *in utero* due to the placental characteristics. This necessitates that piglets obtain all their passive antibodies through colostrum. It is estimated that piglets need about 240 - 255 ml (1.5 kg X 160-170 ml/kg) of colostrum to survive (Le Dividich et al., 2005). These needs are not only for the antibodies (IgG) needed but also for the glucose and fat (both are energy sources) found in colostrum. A recent study by Foisnet et al. (2010) estimated the average sow produced 3.22 ± 0.34 kg of colostrum (range 0.85-4.80 kg). These are similar ranges found by Devillers et al. (2005) which estimated colostrum production to average 3.6 kg with a range of 1.9-5.3 kg. Low colostrum production is not related to litter size or birth weight or due to the inability of newborn piglets to nurse (Foisnet et al., 2010).

Many publications emphasize the importance of allowing piglets to obtain colostrum within the first 24-36 hours after birth before gut closure occurs. It is true that gut closure occurs, but what is more important is to emphasize that this closure is exponential and therefore from a producer standpoint, making sure that piglets get colostrum within the first 6 hours of life is critical. This can be seen in Figure 1 (adapted from Miller et al., 1962). These changes in gut absorption are due to physiologic changes occurring in the intestine related to protein digestion as well as physical changes in the intestine cells (tightening of junctions between cells). In a study by Foisnet et al. (2010) it was found that the average time between birth and the first suckle (colostrum) was 29 ± 2 min.

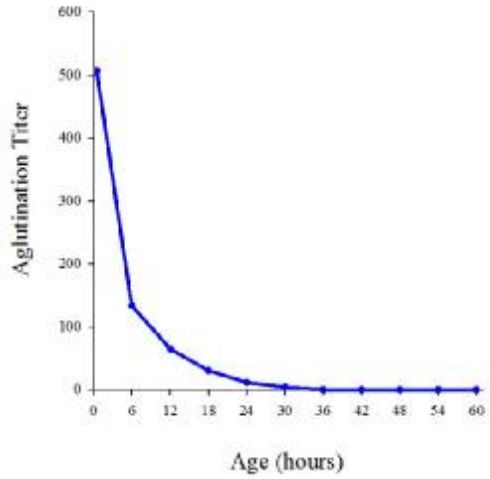


**Figure 1. Serum antibody titer in piglets absorbing antibodies from colostrum.**

Colostrum yield and mean piglet birth weight are important determinants of newborn viability. Birth order also plays an important role in determining which piglets get access to the most colostrum as reported in the review article by Farmer and Quesnel (2009). This same article emphasizes that research supports the theory that it is the sow which limits the quantity of colostrum pigs can consume in a day. The overall mortality rate of piglets within the first two days of life is significantly different between litters nursing off low-colostrum producing sows than in litters with high-producing sows (21 ± 10 vs. 4 ± 3%. $P$=0.04) (Foisnet et al., 2010).

Colostrum also plays an important role in eliciting dramatic changes in intestinal growth, structure and function of newborn pigs during the first 6 hours of suckling. This is highly related to the amount of colostrum ingested and can result in approximately 100-fold increase in absorptive area in the intestines (reviewed by Farmer et al., 2006). It should be the goal of all farrowing house personnel to maximize piglet immunity and intestinal function by maximizing the opportunity for piglets to have access to good amounts of high quality colostrum as soon as possible after birth. This requires not only that the mothers produce the colostrum, but that the right husbandry skills are used to enable this process.

**Husbandry**

**1. Minimizing pathogen exposure.** Disease does not occur unless there are three conditions that are met. You must first have a pathogen that is viable and in high enough numbers to cause disease. Then you need to get these pathogens in contact with the pig. Finally you need to have a pig that is susceptible to the pathogen and therefore disease can manifest. One of the first things to do is to eliminate, if not minimize, pathogen exposure. There are several ways this can be achieved. In the case of enteric problems, other than TGE, most of the other pathogens we deal with are commonly found in farms (*Clostridia*, *E. coli*, Rotaviruses, and Coccidia). Three of the most common practices to reduce pathogen exposure to the newborn piglets involve the cleaning and disinfecting of the farrowing crate, cleaning of the sow before moving into farrowing rooms, and scraping manure behind the sows. These practices make sense and most are supported by some research.

Washing, when done correctly, will remove >99.99% of the microorganisms in the environment. This can be done in conjunction with detergents and hot water to maximize the efficiency and effectiveness of this process. Then the right disinfectant needs to be used targeting specific pathogens on the farm. The disinfectant serves just as the added bonus and should not be relied as the primary means of pathogen control. This is because most disinfectants are inactivated by organic matter and therefore will not be effective unless all organic debris is first removed from the farrowing house. The effect of poor hygiene in morbidity and mortality associated with enteric disease was demonstrated by Svendsen et al. (1975).

Washing the sow before moving into the farrowing crate will minimize the chances of bringing in extra manure from the gestation barn. This is probably more important in outdoor facilities, but even in today's confined environment, some sows get pretty dirty. Cleaning the sow especially regarding the udder and the vulvar area will minimize pathogen exposure especially considering these animals are being placed in a nice clean farrowing crate. It is also a psychological process that helps emphasize the importance of cleanliness. Finally scraping

farrowing crates is not a fun job, but can be an important one. I am not familiar with any research to support the practice, but it just makes common sense that the less manure there is in the back of the crate when baby pigs are born, the less likely they will be exposed to high numbers of different pathogens. Remember that these newborn pigs also have an umbilical cord that has a fresh open wound and will be dragged around right after birth.

Field data also supports the concept of pathogen load. Those piglets that are born first in a room will take 3-4 days before they will start scouring while those born later in the week will start scouring in 24 hours (Cutler et al., 2006). Environmental pathogen buildup can occur quite rapidly especially during an outbreak with enteric pathogens.

**2. Farrowing assistance and immediate post natal care.** Over 50% of preweaning mortality occurs within the first 3 days after birth with most piglets dying having had consumed much less colostrum than survivors in the first day of life (reviewed in Foisnet et al., 2010). Additional supervision of piglets in the first 3 days of life has been shown to decrease mortality from 1.29 to 0.85 pigs per litter (Probst Miller, 2007). To maximize piglet care one must be present at the time of farrowing to be able to help these newborn piglets sooner rather than later. In Foisnet et al. (2010) it was calculated that the average duration of farrowing for 16 sows used in three replicates was 284 ± 50 min. In a study by Gunvaldsen et al. (2007) even with the use of induction protocols, 60% of the sows started farrowing overnight. This same study showed that for every day of gestation, piglet growth increased by 26g ($P< 0.01$). This translated into a pig that averaged 576 g less ($P< 0.01$) at 16 day of age and was 2.0 times more likely to have a relative risk for higher morbidity ($P< 0.01$). The induction of premature farrowing also affects the composition of colostrum and milk especially in regards to fat (Jackson et al., 1995). Fat is an important energy source needed for newborn piglet survival as pigs are born with minimal fat stores.

**3. Split-suckling and cross-fostering.** The concept of split-suckling and cross-fostering theoretically make sense, but research does not always support the practices. With split-suckling the idea is to allow the piglets to maximize opportunity for colostrum intake. I have been unable to find research supporting the practice but I think there are many challenges. A key point is that split-suckling does have the potential of working IF it is done properly. With most piglets being born overnight, it is hard to know how long since the pigs have really been born. This is critical as from the colostrum section we know that the sooner we get pigs to nurse, the better the chances for absorption of antibodies. If not done properly, we can actually create more variation in the process.

A study by Donovan and Dritz (2000) showed there was no statistical difference between split-suckled groups in ADG, weaning weights, and serum IgG concentrations. They did find that the percentage of pigs weighing < 3.6 kg at weaning was higher in the control group (1.3 and 1.6% vs. 3%, $P \leq 0.05$). In this study they split suckled for 2 hours within the first 24 hours of life. It is difficult to know what the effects of just split suckling in the first 6 hours of life could have on the piglets.

In regards to cross-fostering (moving pigs from one sow to another) the overwhelming data suggest that although litter weight variation is reduced, individual pig performance is actually

compromised (Straw, 1997; Cutler et al., 2006). Price et al. (1994) reported that in pigs over 2 days old < 50% of pigs had suckled 6 hours after being moved to a new dam. Pieters and Bandrick (2008) showed that cross-fostering can help transfer antibodies as long as it occurs within the first 6 hours after initial colostrum intake (Table 1).

**Table 1. Proportion of piglets positive to *Mycoplamsa hyopneumoniae* antibodies (ELISA). Adapted from Pieters and Bandrick (2008).**

| | Hours nursing before cross-fostering | | | | Not cross- |
|---|---|---|---|---|---|
| **Group** | **0** | **6** | **12** | **20** | **fostered** |
| Vax Control | NA | NA | NA | NA | 10/10 (100%) |
| Unvax Control | NA | NA | NA | NA | 0/26 (0%) |
| Vax --> Vax | 12/12 (100%) | 11/11 (100%) | 11/11 (100%) | 10/10 (100%) | 11/11 (100%) |
| Vax --> UnVax | 0/10 (0%) | 10/10 (100%) | 10/10 (100%) | 9/9 (100%) | 9/9 (100%) |
| Unvax --> Vax | 10/10 (100%) | 7/9 (78%) | 1/10 (10%) | 0/8 (0%) | 0/8 (0%) |

Dewey et al. (2008) have also shown that cross-fostering before and after 1 day of life can have a negative impact on piglet weight at 26 days of age. In their multivariate model, after controlling for other significant parameters, piglets cross-fostered before day 1 were 0.18 kg smaller ($P$=0.002) and those cross-fostered after day 2 were 0.80 kg smaller ($P$=0.0001) at 16 days of age than those not fostered. Wattanaphansak et al. (2002) also have shown that continuous cross-fostering created almost 3 times as many light weight pigs at weaning than non-cross-fostered litters. They speculated that this could have been due to aggressive fighting amongst commingled littermates. This aggressive fighting could result in less milk consumption by these piglets.

**4. Chilling.** A brief note is important in making sure that the environment in which these newborn piglets are raised is adequate. It is critical to remember that a clean, warm and dry environment is desirable. The challenge becomes in establishing room temperatures and zonal heating in order to maximize sow feed intake, which has a direct impact on lactation, and still meet piglet needs. Newborn piglets have a lower critical temperature (LTC) range of about 30-34$^{o}$C while sows have a LCT around 15-19$^{o}$C. For the first 2 days of life, piglets have difficulty dealing with cold stress (temp < 34$^{o}$C) due to physiological immaturity which does not allow them to mobilize carbohydrate energy reserves (glycogen) efficiently (reviewed in Cutler et al., 2006).

From an immune system standpoint, chilled pigs use energy directed to warming up themselves instead of growing and developing their own immune protection (antibody production uses a lot of energy). Intestinal motility is also slowed down at lower temperatures which then predispose piglets to enteric diseases. Decreased intestinal motility will allow for bacterial overgrowth to occur allowing more time and more pathogens to be exposed to the intestinal tract. Intestinal motility serves as part of the body's innate immune system.

## TRENDS IN FARROWING HOUSE ENTERIC DISEASES

Moeser and Blikslager (2007) have provided an excellent review on enteric pathogens of swine and is a resource that helps summarize the mechanism by which different pathogens cause diarrhea in swine (Table 2). Understanding the mechanism of action by most of these pathogens helps explain the anticipated disease outcome of the different agents. Combining this knowledge along with current trends in disease diagnosis will help better understand the current impact of enteric diarrhea in the farrowing house.

**Table 2. Mechanism that causes diarrhea by different enteric pathogens (adapted from Moeser and Blikslager 2007).**

| Pathogen | Hypersecretion | Malabsorption | Inflammation | Increased intestinal permeability |
|---|---|---|---|---|
| ETEC[*] | X | X | | |
| *Clostridium difficile* | X | | X | X |
| *Salmonella* Typhimurium | X | | X | X |
| Rotavirus group A | X | X | X | X |
| *Lawsonia intracellularis* | | X | X | |
| *Clostridium perfringens* Type A | X | | | |
| *Clostridium perfringens* Type C | | X | X | X |
| TGE virus | | X | | X |
| *Brachyspira* spp.[†] | | X | X | |
| *Isospora suis* | | X | | |

[*]ETEC – Enterotoxigenic *E. coli*
[†]*B. hyodysenteriae* and *B. pilosicoli*

When dealing with farrowing house enteric problems, quick identification and diagnosis of the problem is critical as the pathogens are highly contagious and spread very quickly. This is why it is always critical to treat all pigs in a litter and not just the affected ones. If antibiotics are needed, the right selection needs to be done to maximize effectiveness and minimize the possibility for resistance development.

The latest summary of enteric diagnosis findings from case submissions at the Iowa State University Veterinary Diagnostic Laboratory (ISU-VDL) suggest rotaviruses, *E. coli*, and salmonella are the top three enteric pathogens found in all aged pigs (Figure 1).

### *Escherichia coli*

The number one pathogen in the farrowing house continues to be *E. coli*. Diagnostic submissions do not reflect this often because diagnosis is made many times in the field. There are many different genotypes. The frequency of these varies from area to area.

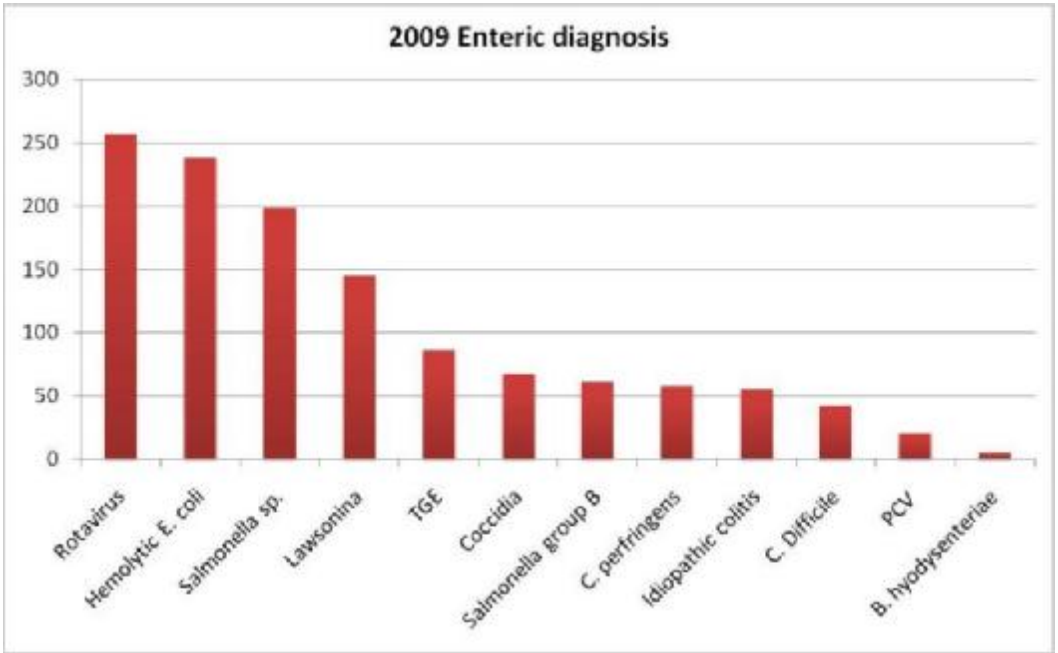


**Figure 1. Summary of swine enteric diagnosis made by the Iowa State University Veterinary Diagnostic Laboratory based on all case submission from 2009.**

Table 3 summarizes some results from the ISU-VDL. Although the PCR genotyping provides information regarding their genetic potential, this technique does not tell us if the genes are being expressed. Knowing the fibrial types we find is critical as it helps to select the correct vaccine that would be needed to maximize effectiveness. The diarrhea that is caused by the ETEC (Enterotoxigenic *E. coli*) is due to hypersecretion leading to malabsorption meaning the piglets will be dehydrated and have electrolyte imbalances.

**Table 3. Results on PCR genotyping at the Iowa State University Veterinary Diagnostic Laboratory in 2008.**

| Associated genes | Number of positives |
|---|---|
| K88 (F4) | 199 |
| K99 (F5) | 79 |
| 987P (F6) | 155 |
| F18 | 162 |
| F41 | 75 |
| Heat stable A toxin (STa) | 306 (35%) |
| Heat stable B toxin (STb) | 431 (50%) |
| Heat labile toxin (LT) | 236 (27%) |
| Shiga-like toxin (Stx2e) | 76 (9%) |

## Clostridial diseases

Traditionally when talking about clostridial diseases it has been in reference to *Clostridium perfringens* Type C. In the U.S. this pathogen has been controlled very effectively with the use of standard pre-farrowing vaccination protocols. Today we have two other clostridial agents that are of greater concern: *C. perfringens;* Types A and *C. difficile*. These two agents of greater concern have not been able to be controlled effectively. In addition, the lack of effective control measures and an increased concern over the agents has led to significantly higher diagnosis of these agents. Survey data from Yaeger (2001) suggested and increase in *C. difficile* diagnosis in cases submitted to the ISU-VDL in 2000 as compared to 1988 (Table 4).

**Table 4. Agents detected in 100 live pigs submitted to the Iowa State University Veterinary Diagnostic Laboratory with a complaint of diarrhea in pigs less than 1 week of age. Adapted from Yaeger (2001).**

| Agent | 1988 (%) | 2000 (%) |
|---|---|---|
| Rotavirus | 8 | 42 |
| *Clostridium difficile* | 0 | 55 |
| No Diagnosis | 8 | 3 |
| PRRS | 0 | 15 |
| TGE | 26 | 6 |
| *E. coli* | 26 | 9 |
| Necrotic Clostridial Enteritis | 18 | 6 |

The incidence of *C. perfringens* Type A is a challenging disease as we currently do not know what toxins are of primary concern in the pathogenesis of disease. It has been reported that a beta 2 toxin was an important predictor of pathogenesis, but current findings do not fully support this (Songer, personal communication). Without the correct toxin identified, it is difficult to have a vaccine which will be effective in providing protection to piglets.

## Rotavirus and TGE

Rotaviruses and TGE (transmissible gastroenteritis virus) are the two most common viral pathogens contributing to enteric problems in pre-weaned piglets. Both can cause significant problems, but definitely TGE is much more severe. Rotaviruses are commonly found in all farms in most aged pigs. Traditionally our veterinary diagnostic laboratories have been focused on diagnosing only Type A rotaviruses. This really means that most of the time a negative result for rotaviruses usually only means the samples were negative for rotavirus Type A only. The lack of test development has been due to the fact that Type B and C rotaviruses have not been adapted for cell growth and therefore it has been very difficult to produce any type of antibodies for testing. New advances have now allowed diagnostic labs to use PCR technology in helping diagnose the presence of all three types of rotaviruses. This is now allowing for the investigation into a better understanding of possible implications in finding PCR positive results for rotaviruses Types B & C in piglets. This area of research is still in its early stages and time will hopefully provide better direction on how to interpret, as well as what actions need to be taken, when finding these agents in scouring piglets.

For TGE the answers are simple. It is not a pathogen expected to be found in any pig. This means that any positive result is significant and must be addressed though an eradication plan. The severity of disease for TGE decreases dramatically with the age of the pig. Piglets less than 2 weeks of age exposed to TGE have a mortality rate close to 95%. In finishing pigs, mortality is rare in affected pigs.

**Coccidiosis**

The incidence of coccidiosis in U.S. herds has decreased dramatically since slatted floors and farrowing crates have been used. In the U.S. *Isospora suis* are the primary coccidia of concern in swine. Coccidia eggs are very resistant to environmental degradation. Once a farrowing house begins to have problems with coccidia, sanitation becomes the primary means for prevention by decreasing egg loads as much as possible. Scouring due to coccidiosis usually manifest in 7-10 day old pigs and definitely cannot occur in pigs < 5 days of age due to organism's natural life cycle. In the U.S. coccidiosis becomes a bigger problem in the farrowing house during summer months when humidity is at its greatest. Currently in the U.S., there are no approved products for the treatment of coccidiosis in swine.

## CONCLUSIONS

Weaning weight is considered one of the most important factors impacting post-weaning and lifetime growth performance (Lawlor et al, 2002). Piglet enteric diseases are a significant contributor to piglet morbidity and mortality in the farrowing house. Piglets must be cared for properly in order to maximize their immunity which will ultimately have a better outcome on their survivability and performance during this early phase of life. Proper colostrum and husbandry management are critical in helping maximize piglet survival. A better understanding of the mechanism for diarrhea by the most common pathogens found in the pre-weaning period are critical in better diagnosis, treatment, and prevention of enteric problems in the herd.

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# VALUE-ADDED PORK PRODUCTION: WHAT STRATEGIES ARE WORKING TODAY?

**Gary Huber**
**Pork Niche Market Working Group**
**2402 South Duff Avenue, Ames, IA 50010**
**E-mail: gary@iowafood.org**

## ABSTRACT

Succeeding with value-added pork production for niche markets requires a broad set of skills on complex topics. Important niche pork attributes in the past have included taste, animal welfare, perceptions of impacts on human health, environmental stewardship, the "story" of the brand, traceability, and third party certification. Failures have occurred, but successes have as well. Some possible areas for continued differentiation include heritage breeds, pen-raised with bedding, unique diets, locally-raised, certified organic, and values-based supply chains. Opportunities will continue, but success will require attention to superior management and continuous adaptations based on changing conditions.

## INTRODUCTION

Thank you for the invitation to speak to you today. These comments and ideas are my own; I accept full responsibility for what I am presenting. They come from my experiences as coordinator of the Pork Niche Market Working Group (PNMWG). The PNMWG started in 2002 and is made up of companies, organizations, and agencies based in Iowa and surrounding states. We work to try to help address the challenges involved in producing and marketing what we call niche pork. In the process, we have learned much about this segment of the industry. I hope I can help you with what I have to offer on this topic.

## HISTORY OF NICHE PORK IN THE UPPER MIDWEST OF THE UNITED STATES

The development of niche pork products in the Upper Midwest region of the United States began over ten years ago as a result of the convergence of two factors. One involved extremely low prices for hogs in late 1998. The other was an increase in demand for products with various unique attributes.

The first led some producers to begin to develop systems to market their pork products directly to consumers and foodservice and grocery store buyers. The second led to alternative production systems that focused on various attributes that were becoming important.

This new world was a complicated place. Developing systems to produce and market niche pork products required that these new businesses learn a great many skills. These included:

1. processing, carcass utilization, and labeling issues;
2. finding customers, understanding their needs, and employing effective promotional strategies;
3. figuring out the logistics of transporting live animals to processors and finished products to customers;
4. managing inventories, developing invoicing systems, and getting paid;
5. finding and maintaining financing, plus figuring out how to price products to make money;
6. dealing with the challenges of working with biological systems to cost-effectively produce a steady supply of hogs year round using methods that resulted in attributes desired by customers;
7. personnel issues, or finding and maintaining the right talent in the right places; and
8. developing and maintaining good relationships with partners all across the supply chain.

The leaders of these new businesses also needed products that were sufficiently different in ways that mattered to buyers. They focused on seven main kinds of attributes, sometimes combining them in various configurations. These were:

1. taste, which led to the rise in brands that used Berkshire genetics;
2. animal welfare issues, which led to brands that required bedded pens, outdoor access, longer times to weaning, and restrictions on tail docking;
3. perceptions of impacts on human health, which led to prohibitions on using antibiotics or animal byproducts in feeds;
4. "credence" attributes, or the "story" behind the brand (who you are and what you care about);
5. environmental issues, or the use of production systems with environmental benefits;
6. traceability, or being able to follow product back through the supply chain to its source; and
7. third-party certification, or being able to prove your claims, such as certified organic.

So, what has happened over the last decade? There have been casualties, meaning brands that didn't make it. Some examples from where I'm from are a brand called Wholesome Harvest, which was a certified organic company. It isn't clear why they didn't succeed; raising and marketing organic pork is very challenging. Two other certified organic brands still exist, but

they are challenged by the severe requirements that come with being certified organic and confusion in the marketplace about what organic means.

Another was VandeRose Farms, which marketed pork from Duroc-sired hogs that came from one Iowa farm. They even had a retail outlet for their products in California, but in the fall of 2009 they got out of the business because of a combination of issues, including the ill-advised purchase of a processing plant and an accountant who was not providing accurate financial information.

There have been others who have failed as well, and some are only just barely hanging on. It is a hard business model to make work for all the reasons that I mentioned earlier. Add in the economic downturn that happened in 2008, and the world can look pretty dark for this segment of the industry.

## TWO SUCCESS EXAMPLES

There have been successes. Niman Ranch and Eden Farms are two examples from my part of North America that are making money. I was asked to talk about what is working. I will use what I know about these two businesses to try to answer that question.

**Niman Ranch.** This company has several features that have helped them succeed. One is brand recognition. They have done a wonderful job of creating a perception of their brand that includes very high quality products, plus the values of environmental stewardship, happy and healthy animals, and small family farmers. In other words, a key to this brand's success is the "story" of the brand.

The importance of the focus on small family farmers is worth a bit more explanation. Niman's system involves working with a network of about 500 small farmers spread across a large portion of the United States. They have invested quite heavily in staffing to coordinate the supply of hogs from this network, but it is a key part of their story and a main point of differentiation.

For example, they do an annual farmer appreciation dinner every September where these farmers are guests of honor for a meal prepared by chefs from restaurants that serve their products. They give awards to farmers with the best meat quality. They give out scholarships using funds donated by customers to children of the farmers to study animal science and help bring in the next generation of Niman Ranch farmers. It is part of a carefully crafted strategy that builds the story of the brand.

Another helpful Niman feature is that the owners of the brand also own their packing plant, which is Sioux-Preme Pack in Sioux Center, Iowa. Owning a packing plant is often a recipe for failure, but Niman's situation is unique because this particular plant does custom processing for a large number of Upper Midwest niche pork brands. Their toll processing business is very profitable. It may also give them a unique view into their competitors' businesses.

**Eden Farms.** This company has been successful as well. They market pork from Berkshire hogs. One key to their success is a laser tight focus on meat quality, which includes visually inspecting every carcass as it moves off the processing floor into cold storage at the plant they use in Des Moines. This attention to quality is a main point of differentiation, and they highlight this feature heavily in their promotional efforts.

A second key to Eden's success is how they have legally structured their business. They have a Limited Liability Company where the brand is owned by the farmers who produce the hogs. How it works is they use a set pay price for the live animals, they have the hogs custom processed, and they sell meat primarily to high end restaurants in several areas across the United States. They then pay for expenses with this income and distribute the profits back to its owners based on who supplied the hogs. What this structure has done is vested the producers in the business in a way that they work very hard to make sure the company succeeds.

## WHAT IS ON THE HORIZON FOR NICHE PORK

There is more to the success of these businesses than what I have conveyed with my simplistic observations. But having dispensed with a part of the task that was given me, let me turn my attention to an even more dangerous assignment: what is on the horizon for niche pork.

To help frame my thinking about this question, an important concept is how many niche products become commodities once a niche fills up. Antibiotic-free pork is one such product. Major companies in the US have added antibiotic-free pork products. Which attributes have value in the marketplace, but are unlikely to be easily replicated by later adopters? Here's my short list:

**Heritage Breeds.** Examples include Berkshire, Hereford, Large Black, Mangalitsa, and Red Wattle. These are breeds that are prized by high end retailers and restaurants who are looking for ways to differentiate themselves. But productivity issues involved in raising purebred animals, meaning the lack of hybrid vigor that results in poorer growth rates and greater feed consumption, limit their attractiveness to many potential growers. Limited access to the genetics is another restraint on entry. For example, the American Berkshire Association requires the registration of herds to assure that meat sold as a Berkshire only comes from purebred animals.

**Pen-farrowed, pen-raised using bedding.** It is one thing to eliminate gestation crates, but quite another to eliminate farrowing crates. Farrowing crates are used for a reason, which is to reduce crushing losses and make it easier to farrow more sows. Some large companies have attempted to make this system work with large farms in warmer climates that use pasture-based production systems, but these attempts have failed. Maybe this can change, but it will be a huge challenge to ramp up this kind of production system to achieve significant scale.

**Pork from hogs fed special diets.** Acorn pork is a good example. Two PNMWG companies sell specialty pork from hogs fed a diet of at least 60% acorns for three months before slaughter. The idea comes from the legendary acorn-finished ham produced from Iberian pigs raised in oak forests in southern Spain near the border with Portugal. This product will not become mainstream anytime soon. Whether a product like flax-fed pork can be a good niche product

depends on: 1) whether the perceived value is enough to pay for the added costs; and 2) whether it is sufficiently difficult to produce to limit its adoption by large companies. It is unclear whether flax-fed pork has these features. With acorn pork, the perceived value is sufficient, and it is very hard to produce.

**Local.** There is no accepted definition of the term local. For example, someone with Whole Foods defined it as the distance a truck can travel in a day. But buying local is big, and it is likely to continue to have good legs, so to speak. One challenge is securing significant sales volumes, especially in areas with lower population densities. The other is getting all the logistics and infrastructure needs satisfied in a cost effective manner.

**Certified organic.** The main reason I've included certified organic as a pork product that I think will be continue to be available to niche pork companies in the future is because our experiences in the Upper Midwest region of the United States is that the production of a steady supply of certified organic hogs at prices that aren't too much higher than "natural" pork products is extremely hard.

**Values-based supply chains.** This concept has been promoted in the United States by a group called Agriculture of the Middle. The idea is that all partners in the supply chain agree to base their relationships on certain values, such as transparency, fair compensation for contributions of all partners, and selling products with value-based attributes that consumers desire (i.e. environmental stewardship). In many ways it is only a theory, although the group points to some examples that exist right now. The reason I mention it is that it has potential to build on some documented consumer trends, such as authenticity, or the desire of consumers to develop connections based on deeper, shared values.

## CONCLUSIONS

Because of the need to focus on my assignment, I have left out some things. One is that all of the niche pork brands I work with share one challenge – finding adequate supplies of hogs with the proper attributes. Much more attention needs to be placed on improving the productivity of these alternative systems, especially given the price of feedstuffs. I've also not discussed the other end of the supply chain, meaning the power wielded by customers like Whole Foods and how they have been increasing their expectations of suppliers. Finding ways to counterbalance this power is a topic worth exploring in more depth in another venue.

There are opportunities in this segment of the industry. Success requires the same attention to the importance of good management in running a business as is the case in any industry. Niche pork businesses with leaders with good instincts, that are well managed and focus on executing all aspects of operations properly, and that produce products that are sufficiently different in ways that matter to customers, are likely to be around longer than others. Those that last the longest will be those that continually adapt to changing conditions.

# THE ROAD AHEAD

# RETHINKING PIG BARN DESIGN

**Larry D. Jacobson**
**Professor and Extension Ag Engineer**
**Dept of Bioproducts & Biosystems Engineering**
**University of Minnesota**
**1390 Eckles Ave., St. Paul, Minnesota, 55108**
**E-mail: jacob007@umn.edu**

## ABSTRACT

New pig barn designs were developed that provided optimum housing conditions which would maximize pig production efficiency. It was anticipated that any additional investment in building a barn to provide these optimum conditions must be significantly offset with production efficiencies. Two other principles guided the design process. First, reductions in inputs /outputs such as emissions and energy must be integrated into the building design rather than done with add-on control technologies. This integration rewards the appropriate management and operation of the system because it is tied to production economics. Secondly, the design must result in improvements to worker safety and health by providing better indoor air quality for workers and reducing hazards related to hazardous gas emissions. In addition, trends in animal welfare were considered and addressed in the design process.

Moving the swine industry forward in more sustainable production should be the long range goal. Results indicate that there are alternatives to the current pig facilities, such as the deep pit, double sided, tunnel ventilated barn that could result in reduced energy and emissions per pound of meat produced while still being economically viable.

## INTRODUCTION

Design, construction, and management of pig production buildings in the Midwestern U.S. have changed little in the past 30 years. Inexpensive fossil fuel and feed, plentiful water, and limited concern regarding air emissions has resulted in few incentives to critically evaluate, modify, or significantly change swine building designs. In fact, recent pig barn designs, such as the tunnel ventilated, deep-pitted pig barns, typically increase rather than lower energy usage and gas emissions. However, recent national and international trends such as air emission regulations, manure management concerns, worker health concerns, animal welfare, escalating feed costs, consumer perceptions have and will force the pork industry throughout North America and hopefully the world to rethink how pigs are housed and commercially produced.

For pork production this could partially be accomplished through the development and use of smarter and/or "greener" housing designs and management systems that reduce energy (both fossil and feed), limit environmental impact of the gases and particulates emitted plus the manure produced, maintain good indoor conditions for workers including air quality, provide for the welfare of the animals, and promote consumer acceptance of pork. Some of these reductions will result from obvious sources such as the selection of more efficient equipment like high

quality fans and energy efficient lights, but most of these need to come from the design of innovative building and ventilation systems (NPB, 2007) that might include modified sensors and controls, new manure management systems, and smart pig management systems that reduce energy usage while still maintaining indoor air quality and pig performance.

Presently the design of pig housing systems has been driven more by:

- Construction costs
- Ability to site the facility
- Convenience or easier barn management
- Builders, Equipment Suppliers, Veterinarians, and other practioners.

And less by:

- Animal (pig) performance
- Animal welfare
- Building performance (energy efficiency, durability of materials, indoor air quality, etc.)
- Environmental issues (manure management, air emissions, mortality management, etc.)
- Engineers and Design Professionals.

Estimates of energy use in animal production can be found on the USDA's website (http://ahat.sc.egov.usda.gov/) but ventilation fan performance, lighting type, and building insulation are the only parameters used in the site's energy evaluation. Although improvements in energy efficient fans and lights will indeed reduce some building energy use, more significant amounts of energy can be saved by proper selection and management of ventilation sensors and controllers that operate fans, inlets, and heaters, the use of durable and well fitted building materials. Additional and even greater economic benefits might be realized through enhanced pig performance due to improved environmental control and indoor air quality.

Other parameters such as air emission reductions will come through integrated changes and modifications to both the environmental control and manure management systems. Animal welfare concerns will be addressed by altering floor designs, penning arrangements and changing equipment that is installed in our buildings.

Ideally, swine buildings should be designed and built as an integrated "system" not as separate components. Presently most buildings are assembled piecemeal by multiple individuals: who independently build the structure and then install the ventilation, manure collection and storage, and the feed storage and delivery systems. An integrated design should focus on providing optimum conditions for maximum pig production efficiency while reducing energy, emissions and addressing worker health and safety and pig welfare issues. It is anticipated that the additional investment in building a barn to provide these optimum conditions must be significantly offset with production efficiencies. Also, there should be the assumption that the "building efficiencies" should be integrated into the building design rather than accomplished by add-on technologies. This integration rewards the appropriate management and operation of the system because it is tied to production economics.

## BACKGROUND

### Site vs Production Based Accounting

Energy, feed, or other inputs, as well as outputs such as air emissions and manure, to an animal production system are often tied to a particular site. These are typically reported on a year or month per site or either as a per pig space basis or a per pig produced basis. Rarely is either of the inputs / outputs reported on the quantity of production (e.g. pounds of pork produced). Because of how inputs or outputs are expressed or what they are divided by, producers can misevaluate the energy use or gases emitted from a site or farm. For example, what may be seen as high energy use or high gas emissions on a site or farm basis may in fact result in more efficient energy use or reduced emissions on a pound of product produced basis. This is especially true when winter ventilation is managed (reduced) to save fuel (L.P. gas) that results in poor indoor air quality which in turn results in reduced animal performance, or when facilities have excessively high indoor temperatures in the summer resulting in heat stressed animals, also resulting in reduced pig performance. The result is a savings in energy costs but a likely increase in feed cost per pounds of pork produced.

### Optimizing the Environment = Maximizing Pig Performance

Instead of focusing on a specific input or output, pig housing systems should optimize the barn environment for maximizing pig performance. Curtis (1973), along with subsequent texts and articles on animal environment and production performance (Mount, 1975; Hahn et al. 1987; Brown-Brandel et al., 2000; Huynh et al., 2004a), stress the need to provide an indoor climate conducive to animal performance. Providing this environment requires proper control of indoor temperature, humidity, airflow rates and velocities, and gas concentrations. Unfortunately, in an effort to reduce building costs, barns have been built with inadequate insulation, are drafty, and have heating, cooling, and ventilation systems that do not provide for optimum environmental conditions in the barn.

Baker (2004) provides an overview of all of the parameters impacting the effective environmental temperature of the pig. In general, drafts (high air velocities) and cold surfaces significantly reduce this effective temperature resulting in the need to increase the setpoint temperature and subsequent heat energy. Maximizing pig performance and quantifying these results is challenging due to the complexity and interactions of multiple factors responsible for performance. In general, ideal temperatures are mostly reported to be about 65-70°F (18.3-21.1°C) with some work suggesting ideals extending outside this range (Figure 1). Factors such as beginning and ending pig weight, group size, pig space allocation, and genotype may be responsible for part of the variation in the reported ideal temperature.

Nienaber et al. (1987), with pigs fed from 96 pounds to 195 pounds, (43.5-88.5 kg) reported pigs maintained at 77°F (25°C) gained 82% as much as those housed at 68°F (20°C) and required 103% as much feed per unit of gain. Pigs at 88°F (31°C) gained 58% as much as the ideal situation (68°F, 20°C) and required 118% as much feed per unit of gain. Lopez et al. (1991), with data collected on pigs starting at 198 pounds (~90 kg) and fed over a 21 day period, reported that pigs maintained at 77°F (25°C) gained 90% as much as those housed at 68°F

(20°C) and required 101% as much feed per unit of gain. Pigs at 85°F (29.5°C) gained 80% as much as the ideal situation (68°F, 20°C) and required 103 % as much feed per unit of gain.

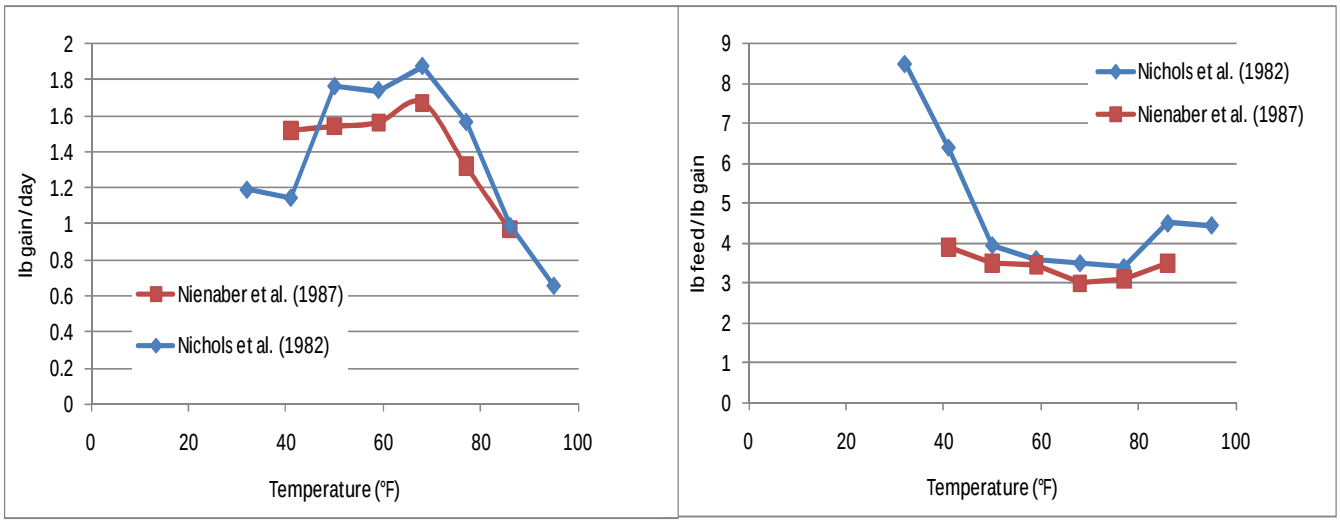


**Figure 1. Temperature vs pig performance (daily gain and feed conversion) for grow-finish pigs (modified from Hahn et al. 1987).**

Massabie and Granier (2001) conducted two experiments, with 192 pigs each to determine the effects of air movement and ambient temperature on pig performance and behavior. Treatments included three ambient temperatures (28, 24 and 20°C or 82.4, 75, and 68°F) combined with two air velocities (still air or 0.56 m/s at d 1 increasing up to 1.3 m/s at d 43). It was concluded that for the hotter environmental temperatures air velocity improved ADFI and ADG but lowered FE and lean tissue percentage. However, at temperatures near the optimum, 68 to 75°F (20-24°C), air movement had a negative effect on pig performance. ADG was higher but feed efficiency declined and lean tissue percentage was lower. This suggests that achieving optimum temperature through methods (floor cooling, geo thermal) other than ventilation air movement has production advantages. Huynh, et al. (2004b) found that floor cooling significantly increased feed intake and growth rate under summer conditions. ADG was improved by 0.07 pounds (31.8 g) or about 4.5%.

Brown-Brandl et al. (2000) studied manual and thermal induced feed intake restriction on finishing barrows measuring effects on growth, carcass composition and feeding behavior. Results suggest that high-lean-growth pigs reared in hot environments deposit more fat and less protein than those raised in a thermoneutral environment and fed similar amounts. Backfat difference between manual and thermal induced feed intake restriction at the 26% level was about 0.138 inches (0.35 cm) greater at the 10$^{th}$ rib for the hotter pigs.
Minert et al. (1996) studied the impact of selected hog carcass traits on prices received. Regression model results indicated that increases in backfat led to lower carcass prices. A backfat increase of 0.1 inch (0.25 cm) was associated with an average carcass price decline of $0.88 per cwt. Carcass prices averaged $63.95 per cwt. during the study. Higher carcass prices would increase the effect.

## RESULTS

As part of a pork industry (Minnesota and National Pork Board) supported project on reducing the environmental footprint of pig finishing barns in the Midwestern U.S. (Jacobson et al., 2011), an advisory group of researchers, extension engineers, and industry representatives was formed to rethink pig finishing barn designs for the northern tier of the U.S. swine belt . This group of 12 individuals met three times over 2+ years to discuss, brainstorm, and prioritize building design criteria. The group also met with several researchers and industry representatives from northern Europe to assist in the building design selection process. Table 1 is a partial list of the building factors and a brief summary of recommendations by the advisory team for improving the designs of pig finishing buildings.

**Table 1. Advisory Group Summary of Pig Building Design Recommendations.**

| Factor | Available Options Discussed | Advisory Member Choice and Justification |
|---|---|---|
| **Flooring** | Fully slatted<br>Partial slatted & solid floors<br>Other Flooring | Partial slats have the advantage of less emissions (if managed properly) because of less emission area. Partial slatted pens are also viewed as more animal welfare friendly.<br>Full slats will likely be more accepted by the industry and will be considered as a second design option. |
| **Stock Rate** | Stocking rates per pen could range from 16 to 100 | Stocking rate (pen size) is more of a labor issue or matter of preference. It was generally thought that pens having groups of 30 pigs are most common and easiest to manage. |
| **Pen Size** | More rectangular or more square and stocking density | Stocking density is commonly 8 sq ft (0.74 $m^2$) per pig and pen dimensions for groups of 30 pigs is 10 ft x 24 ft (3.0 x 7.3 m). |
| **Building Size and shape** | | Building size and shape is also a personal preference but typical barns are 1200 head or 2400 head, due to pig flow from commercial farrowing sites. Energy efficiency principles lean toward more square buildings (rather than long and narrow). Barn width is also dictated by construction limitations (width of trusses, etc.). Building layout is generally two rooms of 40 pens/room with a center walkway per room, and a footprint of 100 ft (30 m) wide by 200 ft (60 m) long . |
| **Partial Slat Dimensions** | | Partial slat barn requires a decision on the percentage of slats and solid flooring. With a pen length of 24 ft (7.3 m) the typical ratio of solid to slat is 2:1 meaning a slat area of 8 ft (2.4 m) and a solid area of 16 ft (4.8 m) or a solid floor area of 5.3 sq ft (0.5 $m^2$) per pig. |
| **Manure Collection and removal** | Deep Pits<br>Flush gutters<br>Pull plug<br>Gutter scrapers<br>Belt Conveyors (feces and urine separation)<br>Liquid solid separation<br>Manure Treatment | Long-term ($\geq$ 6 months) manure storage under the barn has been dismissed. Flush systems typically produce more emissions and require manure treatment for flush water. A modified pull plug with a V gutter was shown to produce the least amount of emissions from Danish and Dutch research. Gutter scrapers and belt systems were thought to require too much maintenance and would be rejected by producers. However, shallow gutter scrapers may offer a cost effective alternative in both a full slat and the partial slat floor design. |

**Table 1. (continued)**

| | | |
|---|---|---|
| **Heating** | Direct Fired LP Gas or Electric, Solar Air, Ground Source heat pump (geothermal), Geothermal heat exchanger, Manure storage heat exchanger, Radiant Floor Heating | A need exists to distinguish between make up air heating systems and radiate heating of surfaces. It is probably more effective for pig comfort to provide "zone heating" where floor surfaces are heated and not the whole room or building. This would help the common problem of overheating pig buildings in the winter which heat stress and reduces the performance of pigs. |
| **Cooling** | Ground Source heat pump (geothermal)<br>Geothermal heat exchanger<br>Manure storage heat exchanger<br>Radiant Floor Cooling<br>Fogging<br>Evaporation pads<br>Building Orientation | Barns need to be cooled during warm weather to improve swine production. Fogging and evaporative pads are often used in the industry but typically cannot provide enough cooling to maintain optimal conditions. Cooling options must be evaluated more thoroughly. One new suggestion is conductive floor cooling (in partial slat floors). Since only limited animal heat can be removed through the floor, other air cooling systems such as geothermal or ground source heat pumps should be considered in combination with floor cooling. |
| **Ventilation** | Natural Ventilation<br>Mechanical Ventilation<br>Control Sensors<br>Nocturnal Rates<br>Frequency drive fan motors<br>Air Treatment and Recirculation<br>Fan Placement<br>Inlet Placement | Mechanical vs natural ventilation is needed to maintain cooler than ambient summer conditions in barns. Control systems will be based on the type of heating and cooling system but should provide for micro climate control. Ventilation will be done with a minimum of controllers so ventilation set points can be more precisely managed. Heating, cooling and ventilation will be controlled using temperature, humidity and $CO_2$. A combination of ceiling ($1^{st}$ and $2^{nd}$ stage) and wall (warm weather) fans should be used along with ceiling inlets air that use the attic space and tempering plenum. |
| **Insulation** | | Walls and ceilings need to be well insulated (R15 to 20 and 25 to 30 respectively) to assume warm surface temperatures. If the attic is used as a tempering plenum than the underside of the roof needs to be insulated (R5 to 10). |
| **Feed and Water Systems** | Liquid feeding<br>Dry with swinging nipples<br>Wet/Dry Feeders | Wet-Dry feeders or dry feeders with swinging nipples are acceptable options. Nipple waterers added over slats do aid in training pigs in the partial slatted floor buildings. |

## Manure Handling

One of the key design criteria from the advisory team discussions was the impact of manure on both the barn's interior environment and emissions. From early on the advisory team felt that to maintain air quality in the animal environment some separation between the animal environment and the manure was important. Both scraper and pull plug systems were discussed by the advisory group and both have strengths and weaknesses but in the end, it was decided that scraper systems will likely have a larger impact on barn emissions and barn air quality. As such, scrapers are recommended even though producers are wary of scrapers (moving parts mean more

repairs) but experience with scrapers in several grow-finish barns in Iowa has been positive. Also, an integrator in Missouri is replacing lagoon water flush with scrapers in many of their grow-finish barns to reduce gas and odor emissions.

Scraper systems offer several advantages. With a scraper system, manure is moved out of the barn twice or more each day, resulting in fewer anaerobically created gas emissions. Scraping removes all hazards related to intermittent high gas concentrations and subsequent hazards, during agitation and pumping of deep pits or when the plugs are pulled in shallow gutter barns. In addition, it is anticipated that future barn designs will incorporate energy recovery systems such as digesters, which need daily feeding of fresh manure for better digester performance.

**Cooling**

As discussed above, pig performance is critical to making large reductions in inputs such as feed or energy per pound of pork produced. Finishing barns in the Midwest are either naturally ventilated during warm conditions or power ventilated (tunnel-barns). During hot conditions, reducing heat stress of pigs is limited to the use of periodically sprinkling water on the pigs directly.

Two cooling options were proposed in our study, floor cooling with either evaporative cooling pads or with mechanical air cooling. Floor cooling is required in both cases to insure proper dunging habits for the pigs in the partial-slat options. During hot conditions, the solid floor must be maintained at temperatures lower than the slatted floor to prevent dunging on the solid floor. Floor cooling would be accomplished through PEX tubes installed in the solid portion of the floor. Maintaining the floor at this lower temperature also will remove some heat (estimated at 40-60 BTU/hr/$ft^2$) from the pig through conduction (Kelly et al., 1969). They took this data one step further using an estimated 15 $ft^2$ of surface area per pig and 20% of the lying pig surface area in contact with the floor (3 sq ft) to calculate an approximate removal rate of 140 BTU/hr/pig or about 25% of the sensible heat production of the pig. Although significant, it is likely that this amount of cooling will not have a significant impact on pig performance but only dunging habits.

An evaporative cooling pad system or a geothermal cooling system would be used to further reduce ambient air temperatures. Ceiling exhaust fans with variable frequency drive electric motors would be recommended for all minimum (cold and cool weather) ventilation fans in the geothermal system. These fans are likely to resist wind pressures better than wall fans. Additional wall fans would be needed to provide the required additional air exchange rates for warm weather for the evaporative cool pad option. As a result of this cooling, maximum ventilation rates in the barn would be reduced by 1/3 (to 80 cfm/pig) for the evaporative system and by 2/3 (to 40 cfm/pig) for the geothermal system.

Both cooling systems would use the attic as a plenum to distribute cool air. Two rows of ceiling inlets per row of pens per room are designed with the capacity for all the ventilation air. Inlets are directional to allow for air distribution over the slats or on the solid portion of the floor to aid in controlling dunging habits in the partial slatted barns. Ceiling inlets throughout the barn will provide more uniform and better air quality in the barn for the same ventilation rate. Fans and

inlet controls will be synchronized and controlled by multiple temperature sensors in the barn to help insure uniform conditions.

It was understood that the cost of an improved building design would likely be greater than standard construction and would have to be significantly offset by improved pig performance. Building designs that can reduce emissions and provide cleaner air and greater barn environmental control (like outside manure storage, floor cooling, and geothermal cooling) add to facility cost when compared to current swine finishing designs. One possible method of cost recovery is improved pig performance. Increased ADG, improved feed conversion, lower death loss, and reduced pig health costs can cover all or some of the added costs. Research data on the effects of level and uniformity of temperature and ventilation air speed can be used to estimate improved pig performance for the building design alternatives suggested in this report. However, confidently estimating this improvement is challenging since most available research was collected under constant conditions (such as temperature). Obviously conventional facilities currently in use have environments (temperature, ventilation air speed, humidity, etc.) that vary during the day and season. Effect of short term stress from less than ideal conditions and potential compensatory gain complicate estimation of performance differences in comparisons to more constant ideal conditions in the building design alternatives.

## CONCLUSIONS

The building design concepts proposed are expected to save energy in the winter due to better insulation and environmental control. However, when warm room temperature exceeds the thermal neutral zone and reduces pig feed intake the proposed barn cooling designs would have the largest economic benefit. Building construction costs per pig space are expected from 1.3 to 2 times higher than typical construction for these design changes. These costs are offset by a 3-7% increase in average daily gain and 5-10% decrease in feed consumption per pound of meat produced. Other benefits include better pig health and worker environment. Using these assumptions a standard economic projection has estimated a 6.0 to 13 years to payback over the baseline building (2400 head deep pit, double-sided, tunnel ventilated barn). These economic projections would improve significantly with additional gains in animal performance. It is generally thought that these performance gains are anticipated but there is currently no supporting research data to confidently predict the magnitude of these performance improvements on an annual basis in commercial scale operations. Construction and monitoring of these design concepts is a critical next step in moving to more sustainable pig production systems.

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# PRESSURE ON CONVENTIONAL AGRICULTURE

**Suzanne T. Millman**
**Veterinary Diagnostic & Production Animal Medicine**
**Iowa State University**
**1600 South 16th Street, Ames, IA, 50011**
**Email: smillman@iastate.edu**

## ABSTRACT

Conventional swine production faces challenges from many sectors, and animal welfare is particularly high on the public agenda. Video images of poor husbandry practices and challenges to current acceptable standards require swine producers to be knowledgeable and prepared for ensuring their practices are consistent with current standards, verifying compliance and communicating effectively with the community about how pigs are and should be raised. There is no Gold Standard for swine husbandry, since animal welfare decisions about the best life for pigs is affected by value judgments. However within each system, animal welfare standards can be discussed and developed with stakeholders and compliance verified.

## INTRODUCTION

It is not an easy time to be engaged in animal agriculture. There is uncertainty about best business projections during this period of economic belt tightening by governments and public distrust rising from unfavorable images portrayed in television, newspaper and internet stories. What should conventional swine farmers and the pork industry prepare for, and what is an appropriate response? First, I will discuss general trends in public attitudes regarding animal agriculture and provide some background about how attitudes and behaviours are shaped. Then I will bring some of these concepts home to the farm, with practical suggestions for how farmers and business owners can use this information when planning ahead.

## WHAT ISSUES ARE OF PUBLIC CONCERN?

The majority of North Americans are urban dwellers with little or no interaction with farm animals. When one considers the inclusion of pets as family members in the majority of households, it is not surprising that we are seeing an increase in public scrutiny and oversight of all types of animal use – food production, entertainment, research, and wildlife management (Millman, 2009).

In a survey of public opinion commissioned by the American Farm Bureau, animal well-being ranked relatively low (score 4.15) when compared to the relative importance of human poverty (23.95), human health care (23.03) and food safety (21.75) (Norwood et al., 2007). However, 95% of respondents agreed that “it is important to me that animals on farms are well cared for”, and 81% agreed with the statement “farm animals have roughly the same ability to feel pain and

discomfort as humans". Notably, despite the relatively low rank for importance, 75% of respondents were willing to vote for a law requiring farmers to treat their animals better, and these results are consistent with voter behaviour observed at recent elections in the United States. Gestation stalls are in the process of being phased out in several States, in addition to restrictions on housing of other types of livestock (laying hens, veal calves) and on some types of food production altogether (fois gras). Regional differences exist, and some States, such as Iowa, with less restrictive laws are anticipating an influx of livestock enterprises.

More recently, this group also examined clustering of attitudes about particular livestock housing and husbandry practices. They found that although some issues, such as provision of food and water, were of concern to all respondents there were three distinct clusters of opinion about what components of animal welfare are important (Prickett et al, in press). The first cluster, comprising 14% of the respondents, were concerned primarily about factors influencing the cost of meat. The second cluster (40% of respondents) was primarily concerned about animal suffering, health and comfort of individual animals. The third cluster (46% of respondents) was primarily concerned about whether the animal experiences were similar to what they would encounter in the natural environments from which they evolved. In terms of swine production, these results suggest that there will be increasing pressure for transitioning away from sow stalls due to perceived suffering associated with behavioral restriction and inconsistency with the natural life of the pig. Similarly, it is likely that farrowing stalls will come under criticism in the future with pressure to adopt less restrictive pen housing systems, despite impacts on piglet mortality. Third, I would predict that efforts to address animal welfare through selective breeding of pigs that have greater mothering ability would be viewed favourably, but selection for sows that are not motivated to perform natural behaviours, such as exploratory and social behaviours will not be viewed as an improvement by a substantial proportion of consumers and voting citizens.

## WHAT ARE THE PRESSURES INFLUENCING PUBLIC BEHAVIOURS?

Ethicist Paul Thompson (2010) points out that the differing opinions about what constitutes a good life for animals, in terms of physical and mental well-being or in terms of living according to its nature, are rooted in long standing traditions of ethical thinking about humans and non-human animals. Given the long history in other aspects of ethical decision-making, we can expect that providing more scientific facts will not likely produce one unified view or approach to solving disputes. The same body of factual information has been used to justify retention of sow stalls for health and performance reasons and banning them as unnatural (Fraser, 2008). For swine producers, it will be important to justify practices to customers using factual information relevant to both of these value-based systems. What are the benefits in terms of health, performance, and comfort? How does the practice relate to what pigs would experience in the natural environment? It may also be useful to communicate the evolved niche that our domesticated livestock have developed within – the argument that some species "chose" domestication, living on the fringes of human communities to benefit from access to food and coping with harvesting by humans (see Budiasky (1992) for a nice overview of this body of anthropological research)

Australian psychologist Graham Coleman (2010) refers to the general impression by stakeholders that the general community is misinformed or misguided about animal agriculture, with both sides stepping in with attempts to correct and influence public opinion. Community behaviours used to affect husbandry practices used by farmers, purchasing by retailers and regulations by policymakers include public protests, explicit attempts at persuasion using media and contributions to animal welfare organizations. Indeed roughly 90% of survey respondents in Australia report obtaining information about animal welfare from television and roughly 60% obtained information from animal welfare organizations, magazines, radio talk shows, and family or friends, whereas only 25-30% used formal education, government and internet sources (Coleman and Toukhsati, 2006). Similarly, the Eurobarometer survey of European consumers found television to be the preferred source of information, followed by the internet and then newspapers (Coleman, 2010). Coleman suggests that explanation of husbandry practices and animal welfare issues is best communicated to the public using television documentary formats which can provide detailed, objective information. He notes that explicit mass media attempts at persuasion influence the behaviour of only 5 to 10% of the population, and these behaviours are vulnerable to persuasion tactics by opposing groups. In contrast, research by Hemsworth and Coleman (1998) illustrated dramatic and sustained changes in the behaviour of pig stockpeople towards animals in their care after receiving highly individualized training that included both education and changes in behaviour. Hence, efforts to influence community knowledge and behaviours about farming practices need to be provided in formats people wish to receive and with sufficient detail to allow for sustained opinions that are resistant to explicit persuasion attempts on single issues.

## RECOGNIZE THE CRITICAL CONTROL POINTS IN YOUR OPERATION

One only has to keep an eye on the media to recognize the issues at the forefront of the animal welfare dialogue. There are a handful of concepts that arise time and again regardless of the species, and they hit on a few key ethical points.

1. Animal housing that restricts movement is easily communicated in photographic and video images. In the swine industry, this means that we can expect to respond to questions about sow stalls for gestation and farrowing that provide little space for postural changes. In legislation we consistently see public support for housing that allows an individual animal to stand, lie down, stretch its limbs, turn around and groom itself.
2. Animal housing that fails to provide outlets for natural behaviour. This would include housing on slatted floors that preclude use of bedding or substrates for rooting and oral exploratory behaviours. Provision of environmental enrichment, such as balls or chains that the pigs can manipulate, are points worth communicating since although some consumers will prefer natural materials, provision of ropes and chains acknowledges the pigs as sentient beings rather than objects.
3. Painful procedures in the absence of analgesia or anesthesia, such as castration and tail docking, are difficult to defend. Again, these images are easily communicated through photographic and video media to provoke responses.

Further, awareness that these procedures are typically performed in pet animals with anesthesia and follow up analgesia results in expectations about appropriate veterinary care. Concerns about animal pain are higher in segments of the population that have university education, and given the increasing knowledge about the biology and neuroscience of pain these expectations will only increase over time.

4. Abusive animal handling and abusive language when handling animals is featured in many video exposes and raises concern not only for the animals but for implications for human safety. Domestic violence and other forms of human aggression have been linked to animal abuse and animal cruelty. These actions are illegal and should be considered as such. Rough handling, which does not cross the line into abuse, is also of concern.
5. Euthanasia is always going to be disturbing. I cover this issue in more detail elsewhere, but it is safe to say that you should always behave as if your euthanasia procedure is going to be shown on the evening news. Do not improvise on euthanasia techniques that have not been endorsed by the American Association of Swine Veterinarians or other recognized professional bodies. We can look to the wording of the Ohio livestock legislative actions during the past year to see consequences of poorly thought through euthanasia. Actions that were captured include video of hanging a sow by the neck. The decision by a few individuals to try to defend this behaviour resulted in public mistrust and legal language specifically regulating acceptable on-farm euthanasia procedures.
6. Considering individual animals as products rather than sentient beings capable of feeling pain and pleasure provokes public distrust. Careless tossing of animals, live or dead, without regard to them as a form of life is objectionable to many people. Euthanasia of large numbers of animals is disturbing, especially when these result from economic reasons rather than because of disease or natural disasters. The psychosocial effects of culling large numbers of animals during the UK Foot and Mouth outbreak and during the BC avian influenza outbreak resulted in profound impacts on the communities affected, beyond the farmers, veterinarians and responders of the community directly involved (see Millman et al. (2008) for panel discussion at a conference in Guelph on this topic). Moral conflict can arise in these situations due to animal welfare, wasted resources and perceived inhumanity associated with the enormity of loss of animal life.

## DOCUMENT PRESCRIBED STANDARDS OF ANIMAL CARE

To respond to public criticism about conventional practices, there are several resources that swine producers can draw from. First, ensure that you are familiar with the animal cruelty and neglect provisions in the Canadian Criminal Code, as well as provincial and local laws. Animal cruelty laws typically exempt customary agricultural animal husbandry practices. This is a subjective judgment decision by animal control officers, investigating veterinary experts and by the legal professionals working on these cases. You should be aware of the wording of the law,

and have evidence to support that your husbandry practices fall within generally accepted practices.

The Canadian Recommended Codes of Practice, US National Pork Board PQA+ guidelines and American Association of Swine Veterinarians *On-Farm Euthanasia of Swine* guidelines are all excellent resources as supporting evidence of current industry standards. You should have copies of these documents in your office and available for your staff and for discussions with members of the community. It is also important to have documentation of the compliance with these standards. Animal welfare assessment and auditing tools are available for third party verification, and for use internally to identify strengths and weaknesses within your facility.

Track the date and time of training provided to staff, especially for practices known to be controversial such as piglet processing and euthanasia. There are also opportunities for external training and certification of completion in some regions. For example, at Iowa State University we have launched the Iowa Swine Welfare School with one-day training modules in euthanasia and low stress handling. The modules include both presentations about current science and technologies, and hands on activities where the knowledge is put into practice and competence validated.

It is helpful to also collect written documentation when animal welfare incidents occur. Animal care and handling can be unpredictable, and even with the best training and facilities mistakes can happen. Documenting the date, nature of the issue and how it was dealt with provide evidence of corrective action and efforts to ensure your standard operating procedures are effective and are being followed. This also can help to identify benchmarks for improvements and staff incentives.

## TRAIN YOUR TEAM TO TALK EFFECTIVELY ABOUT ANIMAL CARE

If you have a good idea about the types of topics that you may need to respond to, and you have high quality standard operating procedures and compliance programs about animal care, the next suggestion I make is to get practice speaking about these issues. There are formal programs available for media training, through Ontario Farm Animal Council and other organizations. It is worth practicing speaking points in a non-stressful situation before having to face real questions with real outcome implications.

Animal welfare is a sensitive topic, and terminology matters. Not only should you try to communicate the factual information relevant to the issue, but also the value based components. For example, defend the practices that are defensible but also acknowledge where actions may not have been consistent with standard operating procedures or may need refinement. Use terminology that recognizes animals as sentient beings rather than a pork chop that hasn't made it to market yet. It is also helpful to recognize questions that you may not wish to answer and have some techniques for managing these responses without appearing to be dismissive of the concern.

An important component of communicating with the public is listening to the concerns and questions being raised. Animal welfare is an issue we will be dealing with for a long time, and it is important to be realistic about the likelihood of changing a person's beliefs and behaviours in a single interview. Outcomes you can take away from these discussions are: establishing relationships with members of the community, including those who object to your practices; identification of concerns; and new information about alternative practices that may be more acceptable. You can learn from every interaction, especially those that don't go as you expected, if you take time to debrief your experiences afterwards.

## CONCLUSIONS

Animal welfare is only one of several social issues that face conventional swine production. Understanding current public opinion of husbandry practices is important for swine producers to plan their response and develop future business plans. Public opinion can be influenced by objective information, especially when provided in a preferred format for receiving information. Television documentaries have been identified as a key format worth developing. Preparing to respond to complaints about animal care includes knowledge of and resources for: relevant legislation; recommended codes of practice; documentation of compliance through animal welfare assessment and auditing programs; and internal record keeping.

## ACKNOWLEDGEMENTS

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# BREAK-OUT SESSIONS

# QUALITY MEAT PACKERS' BRAND STORIES

**Jim Gracie**
**Vice President Marketing and Business Development**
**Quality Meat Packers Limited**
**2 Tecumseth Street, Toronto, ONM5V 2R5**

## ABSTRACT

Success in marketing any product including pork relies on the ability of a product to uniquely and competitively fill an unmet consumer need in the market, and to create a relationship or brand experience with target consumers.

Quality Meat Packers has been a family run meat and pork processor since 1931. From its current location in Toronto, the Company processes 30,000 hogs per week, making it the third largest pork processor in Canada. Hogs are sourced from over 600 farms in Ontario. This presentation highlights four brands of pork that are supplied from Quality Meat Packers that have been successful in the pork category.

## BRAND STORY 1 – WALKING TREE PORK

'Walking Tree' is the brand name for the fresh chilled pork sold in the Japanese market by Quality Meat Packers. Selling fresh pork in the Japanese market requires a meaningful consumer benefit with high appeal in that market. The Japanese consumer values purity, and the assurance of high standards for food safety. Meeting these needs is captured in the 'Walking Tree' brand through the use of images of Canada (pristine and pure) and the producer families (trusting and caring) that grow the hogs.

Support for the brand promise of purity and food safety is done through the sourcing of livestock from six farms in Ontario that make up our "Quality Producer Alliance". These farms follow strict protocols for husbandry, cleanliness, and batch segregation processes. They are regularly audited by a third party and visited by Japanese customers. Further support for the food safety benefit is that the Quality Meat Packers plant is certified under the SQF standards (Safe Quality Foods). This is a standard that is recognized in the Global Food Safety Initiative (GFSI) as the highest level of food safety. Quality Meat Packers was the first meat plant in Canada to obtain SQF certification.

## BRAND STORY 2 AND 3 – LOBLAW FREE FROM PORK AND NATURE'S OWN PORK

There is a segment of consumers in the Canadian market that are looking for purity in the food they eat. They seek to avoid the feeding and medication practices that are often associated with modern farming. A major Canadian retailer, Loblaw Stores is targeting this segment of

consumers with their 'Free From' brand of products. Quality Meat Packers is the supplier of pork for the FREE FROM program in Ontario and East.

The pork program is a true value chain program. Nutrition and diet requirements were developed by Grand Valley Fortifiers to raise hogs without antibiotics, that are vegetable grain fed, and are never fed animal by-products. Started in 2007, now over 35 farms in Ontario raise hogs specifically for the 'Free From' program. Quality Meat Packers provides the segregated processing of the hogs and compliance to regulatory labeling standards as defined by the Canadian Food Inspection Agency. Loblaw Stores merchandises the counter ready packages of fresh pork to be purchased by consumers.

Market potential for so-called niche pork products like pork raised without antibiotics is estimated as 15-20% share at a price premium of 40% over conventional pork. This estimate is based on a 2005 study by R. Parker and Associates.

The 'Nature's Own' brand was developed by Quality Meat Packers to market the processed meats that use raw material from this program. This includes a 'Nature's Own' smoked sausage, black forest ham, and potential for a bacon product.

## BRAND STORY 4 – LEGACY FRESH PORK

The generation of consumers that are entering into their 20's may be the first generation that has never seen Mom or Dad cook a meal in the kitchen. Combined with growing time pressures and the need for convenience, this is the target position for the 'Legacy' brand. Several fresh convenience products have been launched by Quality Meat Packers in the past two years. These are fresh pork products that:

- Are ready to cook, and will be moist and tender even when grilled.
- They are pre-spiced with comfortably upscale spice blends that compliment the meat, not hide the meat.
- Use quality cuts of pork, avoiding the "mystery meat" texture and bite of many competitive products on the market.

'Legacy' products are the fastest growing products in the fresh pork category for Quality Meat Packers and target the younger consumer that traditional pork cuts are missing.

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# BRANDING CANADIAN PORK – DEFINING CONSUMER WANTS

**Anita Ivanauskas**
**Ontario Pork/Pork Marketing Canada**
**655 Southgate Drive, Guelph, Ontario, N1G 5G6**
**Email: saffron@sympatico.ca**

## ABSTRACT

Marketing and business leaders know that a strong brand identity will increase the value of your organization. It may seem peculiar to evaluate branding within the context of marketing fresh pork, but perhaps that is exactly what this industry needs. Canadian Pork is world renowned for its quality and is a highly regarded global brand. Foodland Ontario is also well established and highly regarded for the quality and flavour that 'local fare' brings. At the fresh/unprocessed meat counter we see category segmentation of chicken and beef that provides consumers with products that fulfill a need – premium products that offer superior flavour and texture and commodity products that appeal to the price conscious consumer. The pork category however is generally lacking in this kind of differentiation. The introduction of an overarching brand along with on-line sorting at the plant level could bring the pork category to sales and pricing levels that are typically reserved for other proteins.

## BRANDING

There are so many definitions to choose from. According to *Wikepedia*, 'a brand is a product, service or concept'. According to the *American Marketing Institute*, 'a brand is a name, term, design, symbol, or any other feature that identifies one seller's good or service as distinct from those of other sellers'. My personal favourite definition (unidentified source) however is 'A brand is a promise.' And, a good brand delivers on that promise consistently.

Brand equity is the value of the brand; it is essentially a score of how well a brand delivers on its promise. According to *Interbrand*, a leading global brand consulting organization, the top 10 brands in 2010 – globally and in Canada were:

| Top 10 Global Brands | Top 10 Brands in Canada |
|---|---|
| 1. Coca Cola, $70.5 billion | 1. Thomson Reuters, $9.4 billion |
| 2. IBM, $64.7 billion | 2. TD, $6.7 billion |
| 3. Microsoft, $60.9 billion | 3. RBC, $6.2 billion |
| 4. Google, $43.6 billion | 4. BlackBerry, $6 billion |
| 5. GE, $42.8 billion | 5. Shoppers Drug Mart, $3.4 billion |
| 6. McDonald's $33.6 billion | 6. Tim Hortons $2.6 billion |
| 7. Intel, $32 billion | 7. Bell, $2.4 billion |
| 8. Nokia, $29.5 billion | 8. Rogers, $2.3 billion |
| 9. Disney, $28.7 billion | 9. Scotiabank, $2.2 billion |
| 10. HP, $26.9 billion | 10. BMO, $2 billion |

So, what does this have to do with pork? We know that pork is not a brand, but the top three benefits to an organization that develops a brand are: increased revenues and market share; decreased price sensitivity; and increased customer loyalty.

This is exactly what we have been hoping to accomplish in the pork industry, but just not sure how to get there. It is certainly more difficult in the meat industry because unlike Coke or Tim Horton's, we do not manufacture a product with precision. Our product is, to a certain extent, left to nature and so we must manage what we produce and, like Coke, create an image. One thing that we do know is that consumers are willing to pay for a product that delivers what they expect – every time they buy it.

**Coca Cola**

Who would have thought that a can of sugar and water could be the number one brand in the world, particularly when consumers are becoming more and more health conscious? According to *Interbrand*, Coca Cola has been successful in their marketing efforts because their "brand promise of fun, freedom, spirit and refreshment resonates the world over and it excels at keeping the brand fresh and always evolving – all this, while also maintaining the nostalgia that reinforces customers' deep connection to the brand". Clearly Coke conjures an image in the minds of consumers all around the world and they have thus established a successful brand, partly as a result of this. It seems hard to believe, but perhaps the Canadian pork industry could learn from this global giant.

**Canadian Pork**

Although producer associations are unable to ensure consistency at the counter, we certainly can work together to drive the industry in a particular direction. It is up to the brand owners (retailers and processors) to determine what the individual brands promise and ensure that they deliver on that promise.

The Canadian Pork industry, however, does in fact have a brand that is marketed around the world. According to Canada Pork International, Canadian Pork is world renowned for its quality, and consumers and customers in our export markets see it as 'premium' and one of the most highly sought after pork brands in the world. Interestingly, the specifications required to ship to foreign markets have traditionally been more rigid than they have been in Canada. Could the industry work together in an attempt to provide a level of consistency to Canadian consumers, therein establishing an overarching brand of Pork? How about Canadian Pork for Canadians! The imagery that has been successful in the export market lies within a story that was developed by Canada Pork International –*The Canadian Pork Story*. The imagery employed in part includes beautiful clean vast amounts of land and water, which all contribute to produce some of the best quality product in the world.

**Foodland Ontario**

Similarly, Foodland Ontario has developed a successful brand that resonates locally with Ontario consumers. The imagery that is depicted in Foodland marketing efforts is one of comfort and home and clearly provides consumers with a perceived brand of quality and comfort.

## SEGMENTATION WITHIN THE MEAT COUNTER

The development of the Canadian Pork brand or the Foodland Ontario brand (in the pork category) alone will not turn this industry around. If we look at other proteins in the meat counter, we see two segments within the fresh/unprocessed chicken and beef categories. Both have what we could call a 'Premium segment' and a 'Commodity segment' and each segment provides consumers with a level of differentiation that fulfills a need. The two industries, however, attain these in different ways. The chicken industry has two systems by which the product is cooled (water versus air chilled). By all accounts, air chilled produces a superior product. The beef industry grades on-line to pull out the superior product and sell it at a premium. Although the attributes are not limited to the following, these tend to be the core attributes of some of the brands that are in the market today.

### Chicken

Premium fresh chicken tends to be air chilled and has superior flavour, texture and presentation. Brand examples include Maple Leaf Prime, President's Choice, and Kirkland, and they all command a higher price. Commodity chicken tends to be water chilled, is unbranded, is said to be less tender, and typically has inferior presentation, but delivers a decent product to the price conscious consumer.

### Beef

Premium fresh beef is graded at the plant level, is typically 'AAA' or 'Prime' , is quite often aged and has superior flavour, texture and presentation. It too commands a higher price and a brand example is Sterling Silver Beef. Commodity beef, like chicken, targets the price conscious consumer and tends to be ungraded or graded 'A' and does not always provide the level of consistent superior flavour and texture that comes with the premium brands.

### Pork

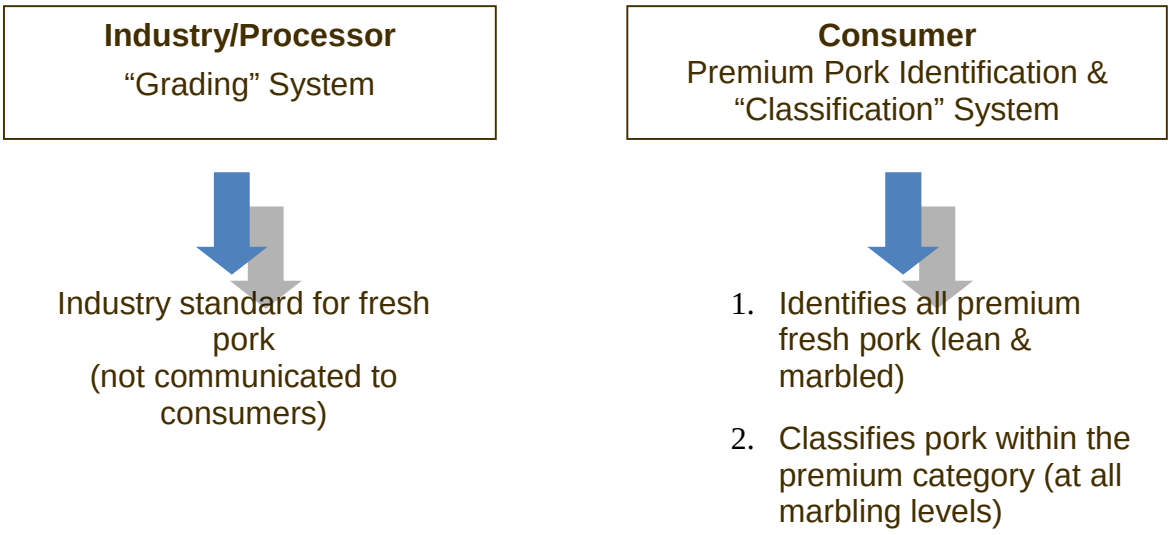
When we think of fresh pork, it is more difficult to identify differentiation or segmentation within the category. Although there are organic and antibiotic free brands available, there is a definite lack of brands that offer, for example, superior flavour or a lean offering. Through a multitude of sensory evaluation testing, we have determined that colour and marbling or fat are important factors in delivering superior flavour and texture. Interestingly, Japan and Korea, who are the most lucrative export markets for Canada, have colour standards and minimal marbling levels that they demand and yet in Canada, retailers have rarely made those demands. An on-line grading system to provide customers with the specification that they are looking for would create consistency for any given brand, thus ensuring that the brand delivers on its promise.

## CONSUMER RESEARCH

For the last 4 years, Ontario Pork has successfully worked on introducing the concept of more heavily marbled pork. The challenge is in the marketing of it. How do you sell a product that

has more fat in it, when consumers have made it very clear that they are interested in lowering their fat intake? In February, 2011, Ontario Pork conducted qualitative consumer research to determine how to communicate marbling attributes as a positive to consumers. The results were exciting. Three levels of marbled loin chops were presented to the consumer – marbling levels of 1, 3 and 5, with 1 having the lowest level and 5 having the highest level of marbling. Although 86% indicated that they would choose the leanest cuts when raw, every participant – 100% – chose the higher marbling level of 5, when cooked. Upon further examination, they suggested that the use of the term 'marbling' was something that required education, but that it was 'natural', and through education they suggested that consumers would understand that this is a valuable attribute. Through one branding exercise, it was interesting to note that the consumers branded the marbling level of #1 as the 'lean choice' and deemed it to be premium. The marbling level of #5 was branded as the 'full flavoured' choice and also deemed to be premium. Both of these product segments were filling a need for almost every consumer in the study. These two categories provided very real and tangible attributes that could be easily replicated in the meat counter and command a premium price. In the real world, it would provide differentiation from ungraded commodity pork that would still be available for the price conscious consumer.

According to Inspire Group Inc, who led the qualitative sessions and provided strategic recommendations, the pork category needs an industry grading system, which could be a two tiered system such as A, AAA and a consumer classification system which would classify pork according to the benefits that it provides consumers. The classification system would be determined by the brand owners.




With producers, processors and customers working together, we can re-create the category by establishing a system that would provide consistent differentiated pork segments in the counter. The continued development of a national or regional brand of pork (Canadian Pork or Foodland Ontario) in concert with the differentiated product in the counter would undoubtedly bring greater value to all sectors of the Canadian pork industry. The assurance of a consistent delivery of a premium pork offering will create value in the minds of consumers, thus establishing brand equity for the Canadian Pork Brand.

# MAXIMISING THE NUTRITIONAL VALUE OF FEEDSTUFFS

**Mike A. Varley**
**BPEX (British Pig Executive)**
**Stoneleigh Park, Kenilworth, Warwickshire CV8 2TL UK**

## ABSTRACT

The current situation that swine farmers around the globe find themselves in is not a new experience for most and some will have seen the current scenario many times. Feedstuffs prices including both energy ingredients and protein sources are both at very high levels and this is causing severe economic problems. It becomes imperative to operate with absolute efficiency in terms of feed efficiency. This encompasses minimising FCR (maximising feed efficiency) minimising feed waste, re-evaluating nutritional requirements for all classes of pig and also a review of the actual feed ingredients used. The specific feed formulations used will mostly have varying levels of safety margin built into the formulations for the principal ingredients but also the premix component and the feed additive package itself. There are usually good reasons to apply safety margins into feed formulations but when the going gets tough it may be time to seriously review these. It is the purpose of this paper to examine and evaluate a variety of nutritional strategies to minimise costs. One of the available tactics is to ensure that health status is as good as it can be because this makes such a large impact on the utilisation of feedstuffs.

## INTRODUCTION

In the United Kingdom we have seen two prosperous years in the swine production industry with good pork prices coupled with relatively low feed material costs. Margins per pig and overall farm profitability have been good during this period.

It has also been evident early in 2010 that this situation was not going to last. The Russian and East European cereal harvest failed to live up to normal expectations due to extreme weather conditions and this culminated in Russia banning wheat exports. This event was concurrent with rising demand for cereals in global markets including China. There was also a degree of failure in other harvests around the world.

All of this, coupled probably with complex speculation on the part of futures traders, led to rapidly rising wheat and other cereal prices. In the UK we are as vulnerable as many others with strong reliance on both imported wheat and maize and also imported soya bean from North and South America.

For the UK industry we operate with feed costs representing about 60-70% of costs of production and hence this current situation, if it continues, is a serious threat to our industry.

With this background landscape, we are re-visiting our nutritional programmes very carefully to ensure that these costs are contained as far as possible. This is not an easy task because most progressive producers have already survived the rigors of the last 10 years and are very fine tuned when it comes to their feed costs. However there may still be some opportunities in most programmes for further optimisation of feed formulations and feeding strategies.

## OVERALL FEED PROGRAMMING

The major determinant of profitability in a high feed cost scenario is likely to simply be FCR (Feed Conversion Ratio) or Feed:Gain ratio as it is expressed in North America. If feed energy and protein rise in value then we really must work hard to extract every Mega Joule of Net Energy from the last kg of cereal and every last gram of digestible amino acids from the protein crops.

What is always evident is the sheer level of variability seen in commercial practice. In the UK in recorded herds we see the top herd producing reared piglets at 30 kg achieving FCRs of 1.44 (kg of feed to 1 kg gain) whereas the bottom herds see 2.34 (kg feed into 1 kg gain). This is a colossal difference and we must examine the likely causes of this to ascertain what can be done to bring up the tail of this distribution.

Firstly, it is likely to be feed intake itself that can have a major bearing on FCR performance. A high level of feed intake is always associated with high daily growth and this immediately takes off many production days of maintenance feed energy and protein. FCR will accordingly decrease (i.e. get better).

Secondly a major factor in realised FCR performance is feed wastage. This is a very mundane and yet difficult factor to evaluate but when this is seriously measured, farms will find that their level of waste is around 5-20%. This level of waste can not be tolerated on either profit grounds or on grounds of environmental impact and in most cases it is simply down to improved hopper and feed delivery systems to tighten up the losses.

In turn, the expression of FCR is related strongly to the prevailing level of health status on the production unit. Since the widespread application of circovirus vaccines in the UK and the regression of PMWS disease, there has been a real focus on health status in general. We have health surveillance systems in place for farms and veterinarians use lung score and other abattoir derived information, and more general disease monitoring by the veterinary profession working closely with BPEX staff. In addition we have initiated regional health improvement programmes around the English industry to induce producers to collaborate much more closely than ever before in eradication programmes for the major endemic diseases such as swine dysentery, EP and PRRS. They formulate coordinated plans within a cluster of farms and then implement these with RDA (EU – Regional Development Agency) financial support. Some of the early data from this programme has shown the benefits of these eradication programmes in terms of both Daily Gain and also FCR performance.

The author also was involved in running a commercial research farm where every batch and every pig on the farm was monitored in great detail. What was apparent from this work where we measured growth and FCR and detailed health status was that within the farm but across batches there was still very large variation in the growth parameters in what were similar batches of pigs treated in exactly the same way with the same feedstuffs and staff working with them.

These variations however were strongly correlated with the (random?) variations in the measured health status between batches. Health status is hence of paramount importance in adding value to expensive feeds. We are currently exploring the use of a national health status index to quantify this rather nebulous concept. This index will be based on various factors such as lung scores for the farm, pharmaceutical use, veterinarian scores and KPIs (Key Performance Indicators). The hope is that this will provide a platform for farms to understand their own performance in relation to benchmarked standards.

## FEED PRESENTATION

Work carried out by BPEX in the mid 1990s confirmed what we knew from earlier studies on feed presentation – that when we use liquid feeds we can achieve a real improvement in FCR that makes more of the nutrients transmit into growth. Feeding systems therefore including pelleting or otherwise is very worthy of critical review. If we are to really capture the benefits from expensive feed materials then using a wet feeding system offers many benefits including the potential for the deployment of co-product feeding that could not otherwise be done. Pelleting in European hands always scores FCR advantages over meal feeding although it is recognised that the USA / Canadian experience is different in this regard. For young piglets this becomes even more critical for feed waste reduction and overall feed intake performance.

One aspect of feed presentation that always poses queries in the UK is whether to home-mix or whether to purchase compound feeds. The argument for compound feeds is that the large feed companies have massive purchasing power and can construct cheap but effective feed programmes. They will however utilise cheap and variable feed commodities and this could be associated with reduced and variable on-farm performance. The argument for home-mixing is that the quality is in your own hands and a consistent high quality product can be manufactured given the appropriate nutrition skills. Finished feeds are generally cheaper and more consistent but there is also the need for investment in manufacturing plant facilities and this is not carried out lightly.

## BREEDING HERD FEEDING

Breeding females have critical requirements when they are in lactation. The raw materials cannot be compromised and the formulation is critical to achieve high feed intake capacity coupled with good milk yield and subsequent reproductive performance. The needs and nutritional requirements of the gestating sow are much less critical. This is because a pregnant sow is influenced strongly by its high progesterone status that immediately ups its FCR performance.

Not only can we apply a low nutrient specification but we can also introduce alternative feed materials that we might not normally use. Wheat milling offals such as wheatings (pollards) and bran are therefore commonly used to good effect in dry sow diets and this is perfectly acceptable in nutrition terms. There may also be further opportunities here with the use of high fibre materials such as citrus products or sugar beet pulp that may have other good characteristics such as improvement in gut health.

A research project at the Rowett Research Institute in Scotland back in the 1970s examined the use of extruded grass or ensiled grass for dry sows. It was actually found that dry sows could extract about 1.25 x M (Maintenance) from high quality ensiled grass silage. This was never taken up other than in small scale operations but could have real potential for savings for some farms.

## REARING HERD FEEDING

The rearing herd with piglets between weaning at 8 kg through to 30 kg is a critical stage of the production cycle but the actual feed inputs can only be a relatively small input in the overall production cycle. Starter feeds, for example, represent only about 3% of the total feed inputs towards a finished pig. However this 3% of initial feeds can account for up to 30% of the variation in growth all through to slaughter.

What is also clear from work carried out at the University of Illinois and elsewhere is that a good head start at the beginning of the growth cycle not only gets them to slaughter much more quickly but it also reduces the variations quite significantly in the time to slaughter within a batch of growing pigs. Variations in slaughter weights is the bane of life for finishing herds and if they can operate with lower coefficients of variation in end weights then feed utilisation will improve markedly together with the effective value from the feed materials.

## FINISHING HERD FEEDING

A large proportion of feed inputs is applied during the growing / finishing period and hence any savings will contribute significantly. This all comes down to ‘precision feeding’ – the ultimate fine tuning of feed formulations, careful selection of raw materials and the use of appropriate feed additives are all important factors. The capitalisation of good health status really can be accrued here. With a high health status not only will good growth be achieved but it will allow for much more wider choice of cheaper raw materials in the feeds. A low health status herd will not have the same options.

Feed formulators also tend to build in a series of safety margins into the nutrient delivery whereas with a very high cost situation it may be more appropriate to reduce these margins to the basic necessities.

## ALTERNATIVE RAW MATERIALS

It is hard to envisage that too many new feed materials will appear on the market any time soon although the 'new' co-products (DDGS) from the bio-fuels industries have been used to good effect already in North America and are just now appearing in the UK feed industries. Glycerol, also from the production of bio-diesel, is a recent new alternative feed material. In Europe also we may see more imported sorghum and tapioca used in the non-ruminant feed industries.

## FEED ADDITIVES

The marketing stories around many feed additives and products has always been very seductive to nutritionists but if we were to believe it all we would not have any space left in the feeds for the real ingredients! The message here is to apply a really critical review on these components and ask the question constantly on the likely cost-benefit ratios of using each and every additive. I am a great believer in simplicity and to start with the basics of organic acids with proven efficacy and then perhaps to use only those necessary gut health promoters that do deliver real performance advantages. It is also the case here that again with a high health status the farm requires far less (if any) expensive feed additives.

## CONCLUSUONS

It is evident from the foregone text that it is possible to increase the on-farm value and performance from expensive feedstuffs. Feed waste reduction is obvious but often hidden on many farms and feed presentation review will always yield improvements. The big wins however will come not from new untested alternative feedstuffs but from the simple upping of the health game. On one of our farm cluster groups in the UK where we eradicated EP in the group, growth rose by about 23% from weaning to slaughter with a similar improvement in FCR. Even with the current elevation of feed costs this improvement will go a long way not only to covering the costs but also to promoting long term business survival.

# MAXIMISING THE VALUE OF FEEDSTUFFS

**Jay Squire**
**Wallenstein Feed & Supply**
**Box 22 Wallenstein, Ontario N0B 2S0**
**E-mail: jaysquire@wfs.ca**

## ABSTRACT

In recent years, swine nutritionists have been spending increasingly more time investigating new approaches to diet formulation in order to address a continuing trend for increased feed costs. The use of alternative feedstuffs may reduce dependence on traditional ingredients like corn and soybean meal. While "alternatives" may provide feed cost savings, it is important to recognize the challenges that can accompany these opportunity ingredients. This paper will address some of the nutritional technologies that exist to maximize nutritional value of both alternative and traditional ingredients found in swine feed today.

## INTRODUCTION

Co-products of the food, beverage and fuel industries are increasing in popularity as potential nutrient sources for livestock. These products are produced in large quantities in Ontario and are often available at a lower cost, relative to more commonly used feedstuffs like corn and soybean meal. In Ontario, the list of alternative feedstuffs can include dry co-products like dried distiller grains with solubles (DDGS) and wheat shorts and liquid co-products like condensed distiller solubles (CDS) and brewer's yeast. While we often refer to these products as alternatives, rising demand for these types of ingredients has "commoditized" their pricing to some extent. With increased pricing due to demand, there is less margin for error when formulating diets with these types of ingredients. There is an ongoing quest by nutritionists and researchers to obtain the most value from these ingredients. Extra value may be found by adopting a number of nutritional technologies, including; new approaches to formulating energy and amino acid balances, incorporation of enzymes and fermentation of feedstuffs.

## BALANCING ON AVAILABLE NUTRIENT BASIS

### Net Energy Formulation

Determining energy content is often the biggest challenge when it comes to alternative feedstuff characterization. As co-products of the food, beverage and fuel industries, these ingredients can often have much of the major energy-yielding starch, sugars and possibly fat removed making it more difficult to predict the available energy content against better understood traditional ingredients. Predicting net energy (NE) from digestible nutrients including protein, fat, starch, sugar and remaining organic matter (fibre) offers a more comprehensive calculation of the "available" energy of an ingredient and allows for better prediction of animal performance de

Lange, 2008). There are tables available that estimate the digestibility of different nutrients within different feedstuffs available from the Centraal Veevoeder Bureau in the Netherlands (CVB, 2003). Different NE calculation equations have been developed, considering the heat increment associated with ingredient digestion, particularly fibre and protein effects on energy utilization in pigs (de Lange, 2008). In the instance of wheat shorts, digestible energy content could be calculated out as close to 80% of the value of corn but when considerations are made for the heat lost due to digestion of this higher fibre ingredient, the "available" net energy content may be calculated as being closer to 70% of the value of corn. NE offers little advantage over digestible and metabolizable energy systems when simpler corn/soybean meal diets are fed, however, the industry trend to feeding more alternative feedstuffs, and their associated complexity, definitely makes the case for this type of "available" energy calculation.

### Digestible Amino Acid Formulation

For maximum cost benefit, producers should be taking advantage of synthetic amino acids and appropriate balances within feed that consider digestibility of ingredient amino acid (AA) content and requirements of different growth stages of animals. Before the dawn of digestible AA determination, rations were balanced on the basis of total AA content, and before that, crude protein (CP) content. Unfortunately, these systems were flawed and never addressed the real requirement for "standardized" ileal digestible (SID) AA.

An excellent example of understanding an ingredient's contribution to SID AA content in feed would be DDGS. At first glance, DDGS may appear to be a higher value ingredient based on its CP content. However, despite being approximately 27% CP, the value of this protein could be considered relatively low when addressing the SID AA requirements of pigs, particularly the first limiting to performance (usually lysine). When compared to a commonly used protein supply, total lysine content as a percentage of CP in DDGS could be as little as half of the ratio that exists in soybean meal. Furthermore, digestibility of that lysine may be as low as 60% for DDGS, compared to 90% in soybean meal. This difference in digestibility is partly the result of heat damage during production/processing of DDGS (Fontaine et al., 2007). As such, increased use of synthetic amino acids, such as lysine-HCl, are crucial to maximizing the full potential of DDGS in swine diets.

Another aspect to consider when feeding higher fibre alternative ingredients to pigs is the impact of fermentable fibre on the pig's intestine. Researchers demonstrated that microbial fermentation in the hindgut increased threonine-rich mucin secretions and as such, increased the requirement of the pig for this essential amino acid (Libao-Mercado et al., 2007; Zhu et al., 2005). As a result, it may be beneficial to formulate to a higher SID threonine to lysine ratio in pig rations containing higher levels of fermentable fibre.

## ENZYME USE

### NSPases

Swine have a limited ability to digest certain types of carbohydrate fibre (Knudsen and Jørgensen, 2001). This includes readily abundant non-starch polysaccharides (NSP) that exists

in swine feed ingredients today (Barrera et al., 2004). Since pigs lack the endogenous enzymes that are required for digestion of this fibre type, they must rely on enteric fermentation to degrade NSP and oligosaccharides into sugars and high-energy organic acids (Black, 2000; Knudsen and Jørgensen, 2001). The extent of enteric fermentation in young, growing pigs is rather limited with fermentation being associated with heat production and gaseous energy losses, which reduces the useful energy supply to pigs (Black, 2000). Arabinoxylans (AX) are one type of this relatively undigested NSP fibre. AX are closely associated with plant cell walls, giving strength and rigidity to cellulose structure. Unfortunately, this same reinforcing trait characterizes AX fibre as an anti-nutritional factor – reducing animal performance. Some AX are soluble and thus, responsible for increasing the viscosity of gastrointestinal tract (GIT) digesta through increased water binding capacity. Increased digesta viscosity can impede digestion by reducing digestive enzyme contact with nutrients, as well as impairing nutrient absorption at the GIT mucosal level. Some AX are insoluble and thus, responsible for trapping nutrients in their fibre matrix making them unavailable to the pig through normal digestive processes.

One nutrition technology that is gaining popularity with swine nutritionists is the use of NSPase enzymes. Specific feed enzymes, including xylanases, have been designed to help maximize nutritional value of ingredients being used. While these enzymes can prove effective in the simplest of diets, their use is probably more justified with increased use of alternative, higher fibre ingredients like DDGS and wheat shorts. These ingredients can carry AX levels in excess of 15% compared to lower levels in corn and soybean meal with less than 5% and 2% AX, respectively. Nortey et al. (2007) proved xylanase supplementation significantly increased the digestible energy of diets containing high levels of wheat millrun (eg. wheat shorts). This increase in digestibility translated into as much as 3-7% improvement in feed conversion in pigs ranging from 40 to 70 kg body weight (Nortey et al., 2007). While not always clear, this energy uplift may be attributed to improved nutrient absorption (reduced viscosity effect in GIT) and liberation (release of nutrients from an insoluble AX fibre matrix).

**Phytases**

Phytates are becoming a relatively well understood anti-nutritional factor. Plant phytates have the ability to bind nutrients, particularly phosphorus, and keep them from being utilized by swine. Phytate-bound phosphorus found in commonly used swine feed ingredients can represent 50-80% of total plant phosphorus and can be dependent on ingredient, plant variety, soil type, environmental conditions and processing (Kirby and Nelson, 1988). Commercially available feed-grade phytase has been a widely used enzyme to address this naturally bound phosphorus and decrease dependence on inorganic phosphorus supplementation. While phytase enzyme is not a new addition to the list of swine feed technologies, there have been new approaches to addressing this enzyme's use in swine feeds.

As mentioned, different ingredients contain different amounts of phytate-bound phosphorus. Some nutritionists have taken a cost savings approach whereby the quantity of enzyme supplementation is based upon the amount of available substrate. For instance, wheat shorts contain a higher level of phytate and as such, it may be intuitive to consider using more phytase enzyme in the feed formulation with higher inclusion rates of this ingredient. However, the time

allowed for the enzyme to liberate phosphorous is limited to a short period of time within the animal's stomach and proximal small intestine. Due to the intrinsic nature of phytase, it may be possible to actually use less of the enzyme and still accomplish the same amount of phosphorus liberation due to higher amount of substrate available for hydrolysation. Phytase continually "frees-up" phytate-bound molecules one after another, not being consumed by the reaction itself. If there is more than enough phytate available, it stands to reason that the odds of the enzyme coming in contact with substrate increase, as well.

Another strategy that may address the quantity of phytase supplementation is to account for endogenous phytase that is already present in some feedstuffs. Ingredients like wheat and wheat co-products can contain higher levels of naturally occurring enzyme activity. While analytical techniques and grain growing/ handling conditions create some difficulty to consistently predict endogenous phytase content in grain, wheat and wheat co-products can contain as much as 1193 and 4381 phytase units per gram, respectively (Eeckhout and De Paepe, 1994). In contrast, corn could be considered to have no enzyme activity with less than 100 phytase units per gram. Wheat based diets may be able to use a lower level of exogenous phytase incorporation.

The feeding value of some ingredients can be further improved by steeping in water with exogenous phytase enzyme before feeding. Niven et al. (2007) demonstrated that steeping high moisture corn with phytase rapidly hydrolysed almost all of the phytate bound phosphorus in just six hours. While practicality may not allow for entire grain portions of rations to be steeped for six hours before feeding, perhaps smaller portions can be and the resultant higher phosphorus availability can be accounted for during formulation.

## FERMENTATION

Fermentation may be defined as the anaerobic conversion of carbohydrates into alcohols and acids by microbes (Davis et al., 1980). The advantages of feeding fermented complete feeds or individual components to pigs have been demonstrated in various studies. Benefits include increased growth performance along with decreased morbidity (Jensen and Mikkelsen, 1998; Scholten et al., 2002; Lindecrona et al., 2003). Unfortunately, anaerobic fermentation requires a certain amount of moisture; making traditional dry feeds exempt from fermentation benefits. With the advance of liquid feeding systems in the last 10-15 years and the use of liquid co-products and high moisture corn, Ontario swine producers have been realizing some fermentation benefits. Possible mechanisms for these benefits may include enhanced feeding value and improved gastrointestinal health in pigs.

### Enhanced Feeding Value

Just as direct enzyme supplementation in swine feeds can improve the nutritional value of various feed ingredients, microbial fermentation can accomplish some of the same benefits through natural nutrient metabolism and enzyme production. Fermentation has been proven to reduce the amount of anti-nutritional phytate found in liquid feed, thus enhancing availability of phosphorus and other nutrients (Carlson and Poulsen, 2003). Many liquid co-products already contain significant amounts of highly available soluble phosphorus, however, for swine

producers not using these products and looking for more available phosphorus supplementation, they can turn their focus to an already widely used ingredient – high moisture corn (HMC). While HMC use is not limited to liquid feeding of pigs, many producers use liquid feeding systems to better manage delivery of this often "more-difficult-to-handle" feedstuff. Due to the ensiling process behind HMC preservation/storage in oxygen-limiting silos, it has been determined that beneficial microbes can increase the amount of soluble phosphorus during fermentation. Since, soluble phosphorus is inversely related to phytate-bound phosphorus, the 4-fold increase in soluble P during HMC storage can be assumed more available to the pig (Niven et al., 2007).

**Enhanced Gastrointestinal Health**

Fermentation of feed ingredients can influence the microbial ecosystem in the pig's gastrointestinal tract through "probiotic" and "prebiotic" effects.

The proliferation of beneficial lactic acid bacteria (LAB) in fermented feed ingredients can lead to establishment of these organisms within the pig. The data in Figure 1 illustrate the establishment of healthier microbiota (e.g. LAB), based on a more favourable balance between LAB and enteropathogenic bacteria (e.g. total coliforms, TC), in pigs fed fermented liquid feed as compared to other types of feeding (Brooks et al., 2001). This competitive exclusion of enteropathogenic bacteria by LAB, could be considered a probiotic effect.

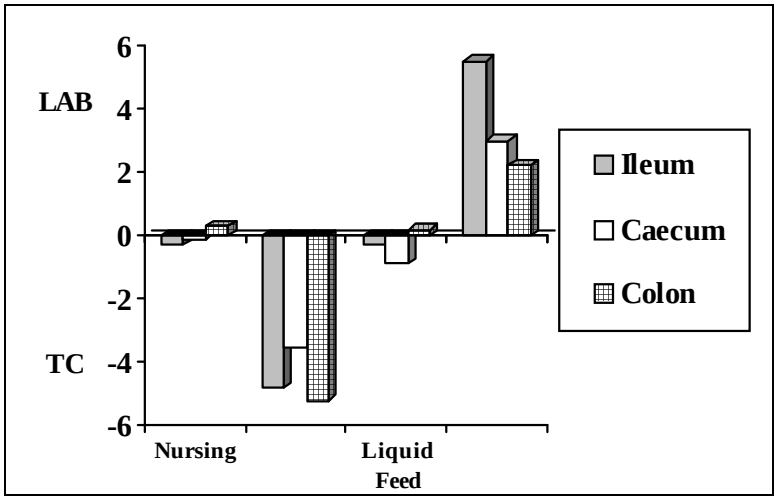



**Figure 1. Balance between lactic acid bacteria (LAB) and total coliforms (TC) in the gastrointestinal tract of pigs for various types of diets (adapted from Brooks et al., 2001).**

Fermentation products, such as organic acids, can benefit the pig through enhancing the digestive and absorptive capacity of the gastrointestinal tract (GIT). Organic acids like lactic acid (LA) and certain volatile fatty acids (VFA), may have physiological influences on immune function as well. Lactic acid, along with VFA, has been associated with enhanced digestion resulting from lower GIT pH and increased enzymatic secretions (Thaela et al., 1998; Scholten et al., 1999). Short chain VFA, and butyric acid in particular, are important for cell proliferation in the intestinal mucosa. Feeding butyric acid has been shown to increase villus height and reduce

crypt depth, thus increasing absorptive capacity of the GIT in starter pigs (Nousianen, 1991; Sakata et al., 1995).

With liquid feeding, many Ontario feed ingredients have the potential to be fermented. However, fermentation of all feed ingredients is not always advisable. When fermenting high value, high protein content sources like soybean meal, producers run the risk of reducing the nutritional value with degradation of amino acids into amines and ammonia which can decrease animal performance due to their toxic effect (Gaskins, 2001). A means to reduce fermentation of protein would be to ferment the carbohydrate portion of a diet separately, rather than the complete diet (Pedersen, 2001; Scholten et al., 2002). Close control of fermentation conditions is important. Several variables exist when implementing fermentation in commercial conditions. The use of commercial bacterial inoculants may reduce the growth performance variability that exists in pigs fed fermented feeds.

## CONCLUSIONS

This paper addressed only a few of the nutrition technologies available for maximizing feedstuff value in swine feeding today. Others technologies not addressed may include, but are not limited to: metabolic modifiers, particle size, heat treatment, pelleting, palatants and preservatives.

Partnerships between producers and nutrition suppliers are the key to improving a farm operation's bottom line. Producers should work with their advisors and nutritionist to maximize the nutritional value of feedstuffs used and to minimize potential profit leaks on their operation. While everyone may believe they are doing a good job, a good farm manager always strives for improvement.

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# EUTHANASIA

**Suzanne T. Millman**
**Veterinary Diagnostic & Production Animal Medicine**
**Iowa State University**
**1600 South 16th Street**
**Ames, IA, 50011**
**Email: smillman@iastate.edu**

## ABSTRACT

Euthanasia is a topic for which there has been little published research, but recent funding by the National Pork Board, Agriculture & Agri-Food Canada and others is producing new technologies and knowledge to support swine producers. The process of dying includes several phases that producers should recognize and be able to communicate to observers to ensure humane death, public trust in the techniques utilized, and respect for the stockpeople charged with taking of life. New research findings for mechanical and gas techniques for euthanasia are discussed.

## INTRODUCTION

Euthanasia is one of the most challenging aspects of swine husbandry due to what are often difficult circumstances in which it must be performed and high levels of public scrutiny. Since good stockpeople value their ability to care for their animals, by its nature euthanasia is a task that many feel uncomfortable about. In order to perform a humane death and to be able to communicate these concepts to our community it is important that producers recognize insensibility and death, to understand the mechanisms through which these stages are achieved with the various euthanasia methods available and to be aware of the advances in science and technology in this production. In the following paper I will discuss two of the most common types of swine euthanasia, mechanical and gas methods, and will share insights about managing the human factors critical for establishing trust that current euthanasia practices are humane and justifiable.

## WHAT IS A "GOOD DEATH"?

The term euthanasia means "good death" (AVMA, 2007), and we should strive to provide all pigs under our care with a painless, unanticipated death. When euthanasia is applied correctly, the pig will go through different phases of the dying process. The pig will first lose consciousness, then move through a tonic phase in which the muscles become rigid and legs are extended stiffly, and then move into the clonic phase during which there is "paddling" or involuntary movements of the limbs. It is not uncommon for involuntary vocalizations or groaning to occur during the clonic phase. These paddling movements occur because the dying brain is no longer inhibiting the neural signals between the spine and limbs. The duration and violence of these involuntary movements are highly variable between pigs, even when they are

in the same weight class and euthanized using the same method. The pig may go through several tonic and clonic phases before reaching the final stages of death, during which the heart ceases beating. Since the involuntary movements can be disturbing to observers, it is important that stockpeople and veterinarians performing this task understand the biology of death, and can explain the stages in advance so observers know what to expect. This sharing of knowledge is particularly important when training new staff, such as summer help.

The most critical step during euthanasia is to ensure that the pig is unconscious or insensible, since pigs in this state cannot feel pain or distress. If our euthanasia techniques produce immediate insensibility, the time required for the heart to cease beating is less of a concern. The ability to feel discomfort, fear, anxiety and depression involves signaling from the thalamus to the forebrain and limbic system (AVMA, 2007). For this reason, the brain stem is the critical structure for determining whether the pig is insensible to pain. We need to watch for reflexes involving this part of the nervous system (see Table 1) rather than the reflexes coming from the spine (i.e. kicking). A pig that is insensible will not display a righting reflex, but it may produce involuntary vocalizations and movements. The speed in which a pig becomes insensible will depend on the euthanasia method applied.

**Table 1. Techniques to confirm that a pig is insensible (unable to feel pain or distress).**

| Measurements | Action | Signs of insensibility |
|---|---|---|
| **Palpebral reflex test** | Run your finger across the pig's eyelash. | No blinking occurs and eye does not move. |
| **Corneal reflex test** | Touch the cornea of the pig's eyeball. | No blinking occurs and the eye does not move. |
| **Pupil dilation test** | Shine a light into the pig's eye. | The pupil is fixed in diameter and does not constrict in response to light. |
| **Nose prick test** | Touch the pig's snout with a needle. | Pig does not move away or respond. |

The guidelines for *On Farm Euthanasia of Swine – Recommendations for the Producer*, produced by the National Pork Board and American Association of Swine Practitioners differentiate between 1-step and 2-step processes. A single step euthanasia method causes permanent insensibility that results in death, whereas a two-step process causes temporary insensibility for which a secondary step (bleeding or pithing) is needed to ensure that the animal cannot recover and that it proceeds to death.

## WHAT DO WE KNOW ABOUT MECHANICAL METHODS OF EUTHANASIA?

Mechanical methods of euthanasia have distinct welfare advantages, since animals are rendered instantly insensible when these methods are employed correctly and equipment is maintained (Millman, 2010). Mechanical euthanasia methods are based on impact of the skull with a solid object to disrupt brain function through (1) laceration or crushing of brain tissue, (2) shock

waves producing axonal injury, and (3) temporary cavitation (EU Scientific Veterinary Committee, 1997). Postmortem examinations have shown that head injuries are likely to be instantly fatal when haemorrhage occurs in the brain stem (Gregory, 2004).

Currently, blunt force trauma is approved for pigs weighing less than 12 lbs (5.5 kg), and is the most common method for euthanasia of suckling and nursery pigs. Research by Dr. Tina Widowski's team at University of Guelph indicates that blunt force trauma is a reliable method for inducing immediate insensibility without return to consciousness for piglets less than 72 hours old (Widowski et al., 2008). However, this method is often viewed as unacceptable by many people, and is much more difficult to perform reliably at heavier weights when pigs are weaning age.

There are new technologies emerging for non-penetrating captive bolt euthanasia of suckling and nursery age pigs, including the pneumatic "Zephyr" developed at the University of Guelph by Dr. Widowski and the non-penetrating head associated with the CASH Special captive bolt gun. Our research group at Iowa State University has been involved with on-farm testing for both of these devices, with excellent reliability and favourable evaluation by stockpeople who have participated in our studies. Current guidelines indicate that non-penetrating captive bolt is only acceptable as a 2-step euthanasia method for pigs greater than 12 lbs (5.5 kg), but Masters student Teresa Casey (University of Guelph) has produced promising results for the Zephyr as a single step euthanasia method in laboratory trials with anesthetized nursery age pigs (Casey-Trott et al., 2010). Similarly, ISU Masters student Jennifer Woods found that the non-penetrating head for the CASH Special captive bolt gun was a reliable single step euthanasia method for anesthetized nursery age pigs, and her findings were also repeated when we tested the method with live pigs at a commercial swine facility (Woods et al., accepted for publication). Among the advantages of this method are the limited skills needed relative to penetrating captive bolt and blunt force trauma. However, one of the advantages often cited for non-penetrating methods is limited to no blood loss. This was not our experience, since bleeding from the nostrils and ear was substantial with both of these devices even when the skin was not penetrated. Furthermore, human safety is a concern when manually restraining piglets and firing at close range. We expect to publish results from these experiments within this year.

Euthanasia using penetrating captive bolt technology or firearms requires knowledge of the skull and brain anatomical landmarks for correct placement of the trajectory (Figure 1).

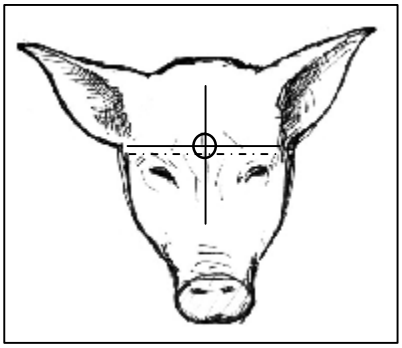

**Figure 1. Correct placement of the trajectory for penetrating captive bolt or firearm euthanasia (Artwork by Dr. Raymond Brooks, Jr.).**

The CASH Euthanizer is a new generation of captive bolt gun, specifically developed for on-farm euthanasia for all weight classes of pig. This system of captive bolt assemblies (varying in length, mass and edging parameters) and multiple strength cartridges has been designed according to the physical skull parameters for each age or size category of pig. Each kit incorporates short, standard and extended length penetrating bolts, in addition to the non-penetrating head discussed previously, and which can be combined with five different cartridges. To validate the device as a single step method of euthanasia, 42 commercial pigs, six pigs in each of seven weight classes (2-3kg, 7.5-10 kg, 15-20 kg, 30-40 kg, 100-120 kg, 200-250 kg, >300 kg), were transported to the Iowa State University Veterinary Diagnostic Laboratory. Within each weight class, half of the pigs were male (barrows or boars) and half were female. Pigs were anesthetized and then euthanized using the recommended bolt length and cartridge for that weight class. Thirty-eight of the 42 pigs were successfully euthanized without a secondary step, and on average they ceased clonic movements or "paddling" 1.7 minutes following firing of the captive bolt pistol. There appeared to be more variability in response in the two largest weight classes, the mature sows and boars, which displayed 2 to 3 times more variability in response when compared with pigs in the smallest weight class On average, death as measured by cessation of heartbeat occurred 3.9 minutes after firing the of the captive bolt pistol. There were no significant differences between the 7 weight classes (Figure 4, P=0.3188). The 4 pigs requiring a secondary step were in the mature breeding sows and boars weight classes. Cerebral cortex Traumatic Brain Injury (TBI) scores differed by weight class (P=0.0068), with TBI scores of mature sows and boars differing from the scores for farrowing, nursery and grower pigs (Woods et al., accepted).

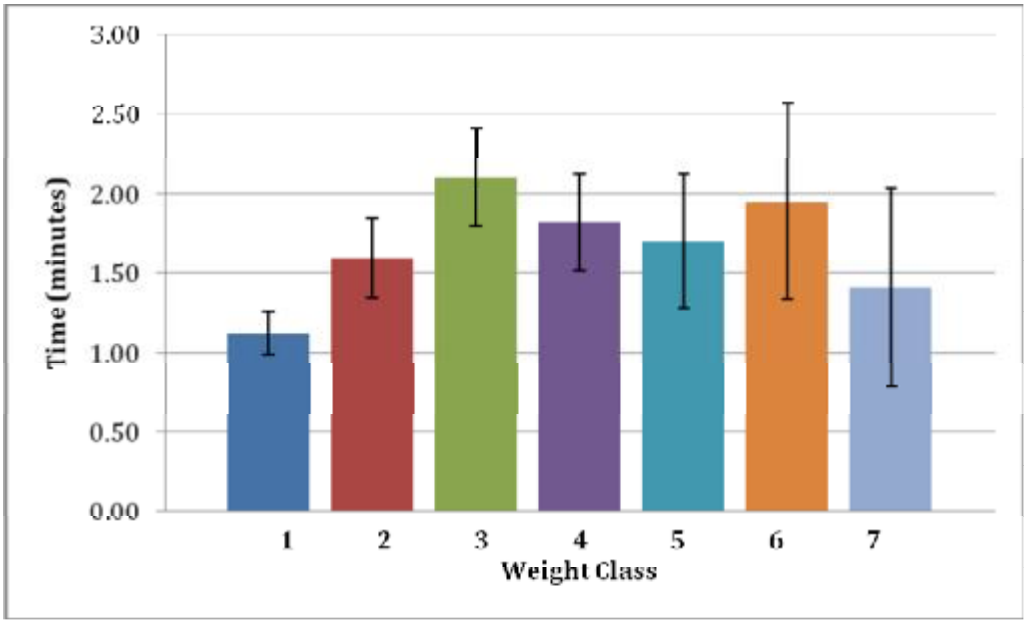


**Figure 2.** **Mean latency to last movement (+/- S.E.) after the CASH Euthanizer captive bolt device was applied to anesthetized pigs of seven weight classes: 1=4-7lbs; 2=16-22lbs; 3=33-44; 4=66-88lbs; 5=220-264lbs; 6=440-550lbs; 7>660lbs (P=0.6990).**

In the second phase of the study, 210 live pigs were euthanized at a commercial swine facility. A secondary step was required for 7 pigs in the largest weight class (Woods et al., submitted). Casual observation suggests that failure to adequately restrain mature pigs resulted in poor

placement and/or incomplete contact of the muzzle of the gun with the skull. We are continuing to analyse the data, but our general impression is that the CASH Euthanizer device is effective as a single step euthanasia method for all but the largest weight classes of pig.

## WHAT DO WE KNOW ABOUT GAS METHODS OF EUTHANASIA?

Carbon dioxide gas is becoming a popular alternative to mechanical euthanasia methods for suckling and nursery age pigs. Gas methods tend to be viewed positively by stockpeople, since they can load piglets into the chamber and walk away, limiting their direct involvement with the process. Gas methods of euthanasia are also generally viewed more positively by the general public and by animal protection organizations than mechanical methods. In particular, Controlled Atmosphere Killing (CAK) methods for slaughter of poultry and swine are often supported by animal protection organizations as an alternative to current techniques since some of the gas mixtures appear to induce unconsciousness with minimal distress (example: http://www.peta.org/features/the-case-for-controlled-atmosphere-killing.aspx, accessed Feb. 27, 2011). Gas euthanasia also has the advantage of being a bloodless method. However, clonic movements or paddling can be violent. Gas euthanasia using carbon dioxide is acceptable for all weight classes of pig, but in reality is only practical for suckling and nursery age pigs. Producers have been manufacturing their own equipment for this process, but commercially available equipment is becoming popular (e.g. SmartBox, by Value Added Science and Technology, Mason City, IA).

Our research group has been exploring the effects of flow rates and an argon gas mixture on piglet distress during gas euthanasia. This project involved collaboration with a company in Iowa, Value Added Science & Technology, and utilized their SmartBox technology for controlled gas mixtures of either 100% carbon dioxide or a 50/50 carbon dioxide/argon mixture. We explored four flow rates: prefill, fast, medium and slow flow rates (50%, 35% and 25% chamber volume per minute, respectively). Piglet behavior was scored for signs of distress (e.g. open mouth breathing) and latency to insensibility and death. Plasma cortisol, a metabolite associated with stress, was also measured immediately after death. Contrary to our expectations, neither addition of argon gas nor gradual fill flow rates conferred benefits in terms of reducing piglet distress. Our data indicates that based on current technologies and the gas mixtures we studied, fast flow or prefill carbon dioxide is preferable despite the distress caused, since this was the most rapid method for inducing insensibility. Based on casual observations from producers that baby pigs are more difficult to euthanize, we also examined the effects of age, using both suckling and weaned pigs. Our data indicates that suckling pigs are affected by gas as quickly or faster than nursery/weaned age pigs at all gases and flow rates (Sadler et al., submitted). Since loss of posture occurred within 97-200 seconds and last movement in 269 (269-529s), the recommendation of 5-minute (300s) minimum duration exposure to carbon dioxide reported in NPB/AASV guidelines is too brief. Cardiac arrest typically follows last movement, and there are risks that removing pigs too quickly from the chamber will result in return to consciousness. It is important that insensibility and loss of cardiac function are confirmed before placing cadavers in the waste storage. Further research is needed to confirm latency to death after the last movement is heard, since unlike our equipment for the laboratory, most gas euthanasia boxes are opaque and hence subtle movements by the unconscious pig cannot be detected. Based on our results, a

duration of 10 minutes when using a fast flow rate of carbon dioxide is a safely conservative estimate.

## WHAT AREAPPROPRIATE ATTITUDES AND CONDUCT FOR EUTHANASIA?

Last, euthanasia should be a solemn process. The attitude that surrounds the process of euthanasia can be the critical factor for whether the public feels it can put its trust in producers. However, killing animals, especially young animals, is particularly distressing for many stockpeople whose ethic is animal care, producing a dichotomy between the job of husbandry and the act of killing (Mort et al., 2008). Individual stockpeople differ in their abilities to perform euthanasia (Widowski et al., 2008), possibly due to physical or emotional challenges. For retention of staff, it is worth taking the time to train the skills for taking a life in a humane manner and to establish a culture of respect for the task of euthanasia. Feeling comfortable with methods of euthanasia is also important for action when humane endpoints are identified for animals in distress.

A critical component of the training and performance of euthanasia is taking the time to confirm insensibility and death after movements cease. Understanding the process of dying and the mechanisms by which the euthanasia methods available produce insensibility and death facilitate sensitive communication on the topic. There is no single “right” method for all situations, but there are wrong ones that have lived on as an unwanted image of animal agriculture.

## CONCLUSIONS

There are new technologies and scientific discoveries in the topic of swine euthanasia. Euthanasia remains a critical control point for public acceptance of animal agriculture, and maintaining public trust. New technologies for swift and reliable insensibility using ballistic and pneumatic captive bolt devices are being investigated, as well as gas technologies for suckling and nursery pigs.

## ACKNOWLEDGEMENTS

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# REDUCING DISTRESS IN SWINE: WHY, WHEN AND HOW

**Tim Blackwell**
**Ontario Ministry of Agriculture, Food, and Rural Affairs**
**6484 Wellington Rd. # 7**
**Elora, OntarioN0B 1J0**
**E-mail: Tim.Blackwell@ontario.ca**

## ABSTRACT

Until recently the importance and value of effective pain control was underestimated in animal medicine. Until recently there have been few products available to decrease pain and distress in food producing animals and many of those that were available were not licensed for use in swine. As a result, veterinarians and swine producers had limited options available to them to treat symptoms such as pain. Recently a few effective products for the management of pain and distress in food animals have become available. We are now generating data in domestic animals that establish the value of these products for specific conditions. It is likely that medications that are shown to decrease pain and stress in pigs will produce the same positive outcomes that have been reported in other species. Effective pain control in both humans and animals has the potential to reduce healing times, improve appetites, and increase the success of various treatment regimes.

## KEY TERMS FOR DISCUSSIONS ON REDUCING SUFFERING IN SWINE

It is useful to understand some common terms when discussing the alleviation of distress in swine.

**Pain and Suffering** – The terms pain and suffering are often lumped together. Suffering is caused by any type of distress an animal experiences. Pain is one type of suffering. If a stockperson with a pig board separates one finishing pig from its penmates, that pig may become agitated and panic and run over the stockperson to return to the group. This pig is suffering fear but is not in pain. The stock person who was run over may well be experiencing pain. We can sometimes relieve suffering due to nervousness or anxiety in animals with tranquilizers. We do this occasionally with gilts at farrowing time. Some highly anxious gilts will suffer less anxiety and her pigs will feel less pain from savaging if we tranquilize the anxious mother to be. We can further ease pain in that gilt if we assist her in delivering a pig that she is struggling to push out. Pain is one type of suffering animals and people experience. That is why it is strange that the phrase "pain and suffering" is so often used. To talk about pain and suffering is like talking about red and colours.

**Anthropomorphism** – This is an unnecessarily large word that means giving human traits or characteristics to non-humans. It is wrongly used to criticize stockpeople by those who know little about animals or animal husbandry. I could be accused of anthropomorphism above when I said the gilt was nervous or anxious. People argue that nervousness is a human trait and that one

cannot prove that any animal is nervous. These people will also argue that we cannot know whether pigs suffer or feel pain since suffering is a human trait and cannot be proven to exist in animals. Such people are best ignored. Animals and people share many of the same traits. Traits such as fear, aggressiveness, curiosity provide advantages in certain situations and have been selected for over millennia. Professional stockpeople know when pigs are anxious, scared, happy, content, depressed etc. That is one of the characteristics that makes a good stockperson good. The best stockpeople think like a pig. That is why pigs thrive under their care. Pigs recognize when we are angry or irritated. Surely we can recognize the same in them.

**Analgesia** is pain control. An **analgesic** is a drug that controls pain.

**Anti-inflammatory** drugs reduce the inflammatory response following tissue damage. Often anti-inflammatory drugs alleviate pain when they reduce the inflammation/swelling related to tissue damage. Anti-inflammatory drugs can be steroids such as prednisone or non-steroidal such as aspirin.

**General anaesthetics** are drugs or combinations of drugs that produce a reversible loss of consciousness. They all produce some degree of analgesia but are not commonly used in swine production. Tranquilizers, in combination with local anesthetics, are generally safer, cheaper, and more practical to use on farms than general anaesthetics.

**Local anaesthetics** are drugs such as lidocaine that are injected into a specific area or nerve to "freeze" or block the innervation. As a result of this injection, the nerves that signal pain sensations from that location do not transmit any impulses.

**Tranquilizers and sedatives** are chemicals that calm or relax animals and can make restraint or confinement less stressful. These products do not block pain. They cause animals to be more tolerant of minor irritations. They prevent suffering in animals by calming nervous or anxious individuals. They help prevent overly excited individuals from injuring themselves or their attendants if the animals over-react to restraint or to unfamiliar environments. These drugs do not strictly speaking control pain.

## BACKGROUND

Pain is a difficult subject to address because it is measured subjectively or by indirect means. There are no objective or direct criteria to measure pain. In human medicine the most common assessment used clinically is to ask a patient to score their pain on a 10 point scale where a score of 1 is no pain and a score of 10 is the worst pain the patient has ever experienced. However this approach is not effective in human pediatric or veterinary medicine. Nevertheless there is little doubt that both infants and animals feel pain. The ability to feel pain is an evolutionary advantage. Pain along with the animal's response to pain increases its chances of survival. Pain is triggered when tissues are damaged. Without pain, an animal would be unaware that a serious injury had occurred and would not avoid the activities that led to the injury or guard the injured area so that it could heal.

## Past Views

In the past there has been a lack of consensus on whether animals feel pain or whether they suffer when they experience unpleasant sensations. This discussion continues to some degree today because of the lack of an objective test to measure pain and the associated suffering the pain causes. Identifying pain is particularly difficult in species that are genetically programmed to hide pain. Animals that are commonly prey for other species have learned to disguise signs of lameness or disease. They have evolved to do this because weak and injured animals are more likely to be picked on by predators. Good stockpeople recognize when animals are in pain even when the animals are trying to disguise it.

Until recently the question of whether one should control pain in animals was not discussed. The main reason for this was that there were few or no licensed products for the control of pain in animals. Veterinary schools made little distinction between tranquilizers and paralyzing agents used for animal restraint and products that actually reduced pain sensations. Tranquilizers and paralytic agents do not have analgesic (pain killing) properties (or do not have them in adequate amounts to be used exclusively as pain medications). The purpose of such drugs was to subdue or restrain the animal so that a particular procedure could be performed. The drug's ability to improve animal restraint was the critical criteria, not specifically whether it reduced pain. The purpose was to ensure that neither the animal nor the person working with the animal was injured if there was a chance that the animal might react violently to the procedure being performed.

## Current Views

The control of distress in livestock is now being discussed by a wide variety of individuals including animal scientists, medical researchers and consumers. Pain has been proven to negatively influence healing in a number of situations. In the last several years, stockpeople have gained access to licensed products that can effectively reduce pain for certain conditions in domestic animals. The question today concerning the control of suffering in livestock is not whether we should control distress but rather when and how.

There are two reasons to alleviate suffering in domestic animals. One reason is financial return. It is well established in human medicine that healing occurs more quickly when patients are not in pain. Pain changes a number of metabolic processes that inhibit healing including appetite suppression. Pain control in human medicine is more than just about being kind and caring to the patients, it is about getting sick people out of the hospital more quickly and reducing the associated costs of their stay. There is a lesson here for us. A recent study in scouring calves demonstrated that the use of a non-steroidal anti-inflammatory drug with analgesic properties improved outcomes and increased feed consumption and average daily gain in treated calves compared to saline treated controls (Todd et al., 2010). We need to test if similar effects exist in swine.

The second reason for pain control is ethical. Domestic animals are our responsibility. They are dependent on us for their basic needs. Wild animals fend for themselves and endure whatever suffering life presents them. Domestic animals are completely reliant on their caretakers and society expects stockpeople to provide domestic animals with food, water, and appropriate

shelter. Without these basic necessities the animals will suffer and society does not tolerate the unnecessary suffering of animals. Because pain is one cause of suffering, we are now seeing appropriate pain control as well as euthanasia added to the responsibilities of animal caretakers.

Providing analgesia or euthanasia to swine in our care are relatively new areas of concern for stockpeople. There are more questions than answers at this stage of the discussion. Most of the questions deal with how and when to either euthanize or provide analgesia. There are limited numbers of products that can be used in swine to relieve pain or distress and almost all are prescription products that must be purchased through a veterinarian. There is little data in swine at this time to say with confidence how best to control pain in sows and pigs. There is nevertheless pressure coming from European consumers and some U.S. groups regarding the need to provide analgesia for what are undoubtedly painful procedures such as castration, tail docking, hernia repair, etc. At present however there are no drugs that have been shown to practically and economically reduce pain associated with these surgical procedures.

It is important to remember that sometimes the most effective, humane, and cost-effective method to end the suffering of an animal is euthanasia. This topic will be covered in a separate presentation.

## PRACTICAL SUGGESTIONS TO REDUCE SOME COMMON CAUSES OF SUFFERING IN SWINE

In this section some general concepts of pain reduction are addressed. No specific drug treatment regimes are recommended as this is best done in consultation with the herd veterinarian. Any attempt here to identify some universal drug therapies to control suffering in swine would be more likely to be ineffective than effective. On-farm trials in consultation with the herd veterinarian will most effectively identify appropriate drug protocols for relieving suffering in swine and improving outcomes. Table 1 lists some pharmaceutical products that may be beneficial for relieving pain and inflammation in swine. The table may be useful when discussing specific treatment protocols with your veterinarian.

In many situations, access to an appropriate hospital pen where the floor is easily gripped for standing and reclining and where there is little to no competition for feed, water, and warm dry resting areas can do as much for reducing animal suffering as any potion in a bottle. Hospital pens ideally should be located where the stockperson passes by several times a day so that changes in the condition of the animals can be monitored.

### Farrowing Gilts and Sows

Occasionally gilts and sows become extremely agitated at farrowing time and may injure themselves or their piglets. The use of a tranquilizer can substantially reduce the distress leading to this behaviour.

There should be no more than 20 minutes between the birth of piglets. Longer intervals are indications for manual assistance and the occasional and judicious use of oxytocin to prevent exhaustion in the mother and stillbirths in her pigs.

Severely lame sows and gilts cannot be shipped to slaughter. If they are to be treated, treatment should include an analgesic. This will allow the sow or gilt to get up easier and consume her normal ration and will improve her chances of recovery.

**Suckling pigs**

Suckling pigs should be attended at birth to ensure they do not become chilled, crushed or denied access to colostrum. Scouring, injured and lame pigs should be treated appropriately. The use of an analgesic as part of the therapy may be beneficial in certain of these situations to allow the compromised pig to more effectively compete at the udder and for suitable resting areas. An effective analgesic for procedures such as castration, tail docking and hernia repair has yet to be identified.

**Nursery pigs**

Recently weaned pigs commonly suffer from bacterial infections in their intestines, brains, or joints. Recent work in calves demonstrated a positive effect from treating scouring calves with an anti-inflammatory drug that has analgesic properties. It is likely worth experimenting with a similar therapy when treating scours in recently weaned pigs.

Meningitis or swelling of the covering of the brain is a very painful condition in people and likely in all mammals. *Streptococcus suis* commonly causes meningitis in pigs. Affected pigs may be found disoriented, circling, head pressing, or recumbent and paddling. The use of anti-inflammatory drugs to reduce swelling in the brain have anecdotally been associated with improved outcomes in pigs suffering from *S. suis* meningitis.

Pain associated with lameness in pigs can often best be treated by moving the affected pig with one or two penmates to a pen with improved flooring and less competition for feed, water, and warm, dry, resting spaces. Lameness due to bacterial infections require appropriate antibiotic treatment. In addition, the use of non-steroidal anti-inflammatory drugs can make the pig more comfortable during treatment and more likely to eat and drink and return to normal function.

**Finishing pigs**

Causes of discomfort in growing and finishing pigs vary widely. Many conditions in growing pigs are best addressed by identifying the problem at an early stage and moving the pig first to a hospital pen and then rapidly to an off-sort market before the condition worsens. This applies to the early and mild stages of such problems as umbilical or scrotal hernias, swollen joints, rectal prolapses, and tail biting. If an effort is to be made to medicate or treat the pig, analgesic or anti-inflammatory drugs may prove beneficial.

## CONCLUSIONS

Stockpeople are responsible for the well-being of the animals in their care. This includes providing food, water, shelter and where possible, freedom from unnecessary suffering.

Professional stockpeople through appropriate animal husbandry practices prevent the majority of pain and distress in swine. A well-designed hospital pen and an appropriate euthanasia protocol are necessary for individual animals that may develop painful or life-threatening conditions. Timely and appropriate euthanasia remains one of the most effective ways to minimize suffering in severely injured or debilitated individuals. Where specific treatments are undertaken, additional therapy with anti-inflammatories and analgesics will likely improve outcomes and relieve some of the discomfort associated with the condition under treatment.

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**TABLE 1. ANALGESIC AND ANTI-INFLAMMATORY DRUGS LICENSED FOR CATTLE, SWINE, SHEEP, AND GOATS IN CANADA.**

| Active Ingredient | Trade Name | Class | Analgesia | Meat withdrawal time after last dose | Milk withdrawal time after last dose | Approved for |
|---|---|---|---|---|---|---|
| Acetylsalicylic acid | Acetylsalicylic acid boluses<br>Asen (240 bolus or P powder)<br>ASA boluses | NSAID* | Implied | No labelled withdrawal | No labelled withdrawal[†] | Bovine |
| Flunixin meglumine | Banamine® | NSAID* | Yes | Swine must not be slaughtered for food use for 13 days. Bovine have a 6 day meat withdrawal. Do not use in calves to be processed for veal. | Milk must not be used in food for 36 hours. Do not use in dry dairy cows. | Bovine, Porcine |
| Flunixin meglumine | Flunazine™<br>Flunixin injection<br>Cronyxin® Injection<br>Suppressor | NSAID* | Yes | Must not be slaughtered for food use for 6 days. Do not use in calves to be processed for veal. | Milk must not be used in food for 36 hours. Do not use in dry dairy cows. | Bovine |
| Ketoprofen | Anafen® ketoprofen injection 100 mg/mL solution | NSAID* | Yes | Swine must not be slaughtered for food use for 7 days. Bovine have a 24 hour meat withdrawal. | Milk from treated cows may be used without withdrawal.[‡] | Bovine, Porcine |
| Meloxicam | Metacam® 20mg/mL solution injection | NSAID* | Yes | Must not be slaughtered for food use for 20 days. Do not use in calves to be processed for veal. | No labelled withdrawal[†] | Bovine |

**Table 1. (continued)**

| | | | | | | |
|---|---|---|---|---|---|---|
| Dexamethasone sodium phosphate | Dexamethasone 2 or 5 sterile injectable solution | Cortico-steroid** | Analgesic through anti-inflammatory effect. | No labelled withdrawal | No labelled withdrawal† | Bovine |
| | Dexamethasone 21 | | | | | |
| | Dexamethasone injection 2 mg/mL | | | | | |
| | Dexone | | | | | |
| | Dexamethasone powder | | | | | |
| | Dexacort | | | | | |
| Flumethasone | Flucort® injection | Cortico-steroid** | Analgesic through anti-inflammatory effect. | Must not be slaughtered for food use for 4 days. | No labelled withdrawal† | Bovine |
| Isoflupredone acetate | Predef® 2X sterile aqueous suspension | Cortico-steroid** | Analgesic through anti-inflammatory effect. | Must not be slaughtered for food use for 5 days. | Milk must not be used in food for 72 hours | Bovine, Porcine |
| Prednisolone acetate | Prednisolone acetate | Cortico-steroid** | Analgesic through anti-inflammatory effect. | Must not be slaughtered for food use for 5 days. | Milk must not be used in food for 72 hours. | Bovine |
| | Prednisolone injection | | | | | |
| Acepromazine maleate | Atravet® injectable | Sedative/Tranquilizer | No | Must not be slaughtered for food use for 7 days. | Milk must not be used in food for 48 hours. | Bovine, Ovine, Caprine, Porcine |
| | Atravet® soluble granules (Labelled for use in bovine and porcine only) | | | | | |
| | Acevet injection | | | | | |

**Table 1. (continued).**

| | | | | | | |
|---|---|---|---|---|---|---|
| Azaperone | Stresnil™ injection | Sedative/Tranquilizer | No | Must not be slaughtered for food use for 24 hours. Not to be used on swine in transit to slaughter. | Not labelled for bovine. | Porcine |
| Xylazine | Rompun® 20 mg/mL solution | Sedative/Tranquilizer | Yes | Must not be slaughtered for food use for 3 days. | Milk must not be used in food for 48 hours. | Bovine |
| Lidocaine HCL products | Lido-2 | Local Anaesthetic | Yes | Must not be slaughtered for food use for 5 days. | Milk must not be used in food for 96 hours. | Check product label for approved species |
| | Lidocaine HCL 2% and epinephrine injection USP | | | | | |
| | Lidocaine HCL 2% | | | | | |
| | Lidocaine neat | | | | | |
| | Lidocaine hydrochloride 2% with epinephrine | | | | | |
| | Lurocaine | | | | | |
| Thiopental sodium | Thiotal (1 or 5g) | General Anaesthetic | Yes | No labelled withdrawal | No labelled withdrawal† | Bovine, Ovine, Porcine |

*NSAID = Non-steroidal anti-inflammatory drugs.

**The use of steroids can inhibit healing of wounds in certain situations.

† Health Canada has not established a labelled milk withdrawal time for this product.

‡ Health Canada has established a zero milk withdrawal time when used according to labelled indications.

Note: Many products have specific warnings and contraindications. Always check the label before administering any drug.

# ENERGY MANAGEMENT

**Robert Chambers**
**Engineer, Swine and Sheep Housing and Equipment**
**Ontario Ministry of Agriculture, Food and Rural Affairs**
**6484 Wellington Road #7 Unit 10, Elora, ONN0B 1S0**
**E-mail: robert.chambers@ontario.ca**

## ABSTRACT

Significant reductions in energy use up to 75% in Swine operations can be achieved with minor operational, maintenance and equipment changes. Proper management, maintenance and equipment selection of the ventilation system is crucial to reducing the energy consumption. Having an energy audit done can assist producers in the steps to take and to identify key areas of concern. Further reductions can be achieved with solar walls, heat exchangers and windbreaks.

## INTRODUCTION

All forms of purchased energy used in swine facilities whether it be electrical, propane, natural gas, heating fuels, etc. have experienced both volatility and a trend of higher costs in the past few years. The vast majority of predictions see this pattern continuing for the foreseeable future. Swine producers facing increasing feed costs have done an excellent job in allocating the proper feed type to the proper needs of each group of animals. The same method should be done in allocating energy requirements to meet the needs of each group of animals. Producers should then investigate alternative methods of energy savings, such as heat exchangers, or alternative heating systems such as solar walls or hot water bio fuel systems.

## ENERGY USE IN SWINE FACILITIES

Energy use in swine facilities is divided between electrical loads, ventilation fan motors, lighting, heating such as creep heaters, and feed motors, pumps and other miscellaneous loads such as heater motors, controllers and etc.

The largest user in fan ventilated buildings is ventilation fan motors and is one that producers should concentrate on. Proper design, sizing, and make of fan along with proper set points, maintenance and cleaning can drastically affect the overall performance and efficiency of the system. Usually 60 to 70% of the heating costs are attributed to the ventilation system and a poorly run ventilation system can also have negative effects on animal performance and building and equipment longevity due to high humidity issues. By lowering the set point to meet the needs of the animal, significant savings can be found. In a recent study done at the IRDA in Quebec, by lowering the usual temperature set points in grow finish swine from 22.2$^{o}$C start to 20.0$^{o}$C finish to a 21.1$^{o}$C start to a 14.4$^{o}$C finish savings of 56 to 60% in heating energy requirements was realized. This was done without compromising animal performance or meat

quality. It was noted though that the set points should be raised during warm weather as all the savings in heating would be lost in increased ventilation requirements.

Lighting is another area where savings can be easily made. Replacing incandescent bulbs with Compact Fluorescent can reduce electrical use by 75%. Replacing the Compact Fluorescent with Premium T8 fixtures can reduce the electrical use by approximately 40% or 16% of the electricity is required to produce the same light as a 100 W incandescent bulb. T8 fixtures are also available in a vapour tight format to protect the lamps from barn humidity and wash down. The life of the lamps are rated at 30 000 hours, 3 times that of Compact Fluorescents. Another large user of electricity in Farrowing units is 250 W infrared creep lamps. By replacing these with electric heat mats with controllers, electricity can be reduced by 66%. Hot water pads can also be used if a hot water system is in place or installed. Further electrical saving can be achieved if high efficiency electrical motors are used to replace worn out motors in such things as the feed system, water pumps, manure transfer system, etc. Savings of 1.5 to 5% can be expected. The more the motor is used the greater the savings. By using water saving bowls, wet-dry feeder and troughs instead of nipple drinker's savings of 20% of water use along with the associated water pumping and manure removal costs.

## BUILDING ENVELOPE

Even though heat losses through the building envelope are minor compared to the ventilation system, they should not be ignored. Seal up all air leaks. Not only do they contribute to energy losses but can cause animal discomfort and in certain instances contribute to deterioration of the structure. Insulation levels should be R 20 in the walls and R 30 to 40 in the ceiling. If the attic space is being used as a plenum, consider insulating the underside of the roof to R5 to reduce condensation and solar heat gain in the summer.

## ADDING IT ALL UP

While no one change may cause a major reduction in energy, added up they can make a huge difference. A large Manitoba based swine loop was able to achieve savings of $200,000 per year in 15 finisher farms.

Having an energy audit done can also suggest reductions. Operations can vary in energy consumption by a factor of 4, producing the same volume of pork. Auditors can develop a "shopping list" of suggested tasks and equipment changes that an operator can then focus on to reduce their overall energy costs.

## OTHER ITEMS

Tree windbreaks planted strategically around the facilities can reduce heating costs by up to 25%. An added benefit is that snow removal costs can be lowered as well and odours from the facility are lowered. Many of the Conservation Authorities offer free planting layouts and trees

are supplied free or at a discount. The biggest issue is that it can take up to 10 years before results are noticed.

Solar walls can be used to supplement the heating system. In a study of a nursery barn in Quebec, heating costs were reduced between 23 to 31% over the winter months.

Heat exchangers can also be used to pre-warm the incoming air with the exhaust air. Exchangers must be designed so as not to be adversely affected by the condensation and resulting dust/slime build up on the exhaust side of the exchangers. In below freezing temperatures, frost build up on the exhaust side can also be an issue. Some designs require regular washing in order to maintain their efficiency. With proper design and maintenance, heating energy savings of 60 to 70% can be attained.

## CONCLUSIONS

There are significant energy and dollar savings to be had in swine barns. By properly managing the ventilation system and replacing energy inefficient lights and motors with more efficient equipment, producers can lower their overall energy costs by up to 75%. By adding items such as wind breaks, solar walls and heat exchangers further reductions can be achieved.

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# VENTILATION MANAGEMENT

**Harry Huffman**
**Agricultural Engineer**
**Huffman Consulting**
**86 Southfield Crescent, London, Ontario, N6K 2B7**
**Email: harryhuffman@rogers.com**

## ABSTRACT

While good air quality is required, the ventilation system must be well managed to prevent over-ventilating and wasting feed energy, heat energy and electrical energy. This presentation discusses a number of common ventilation problems found in swine barns that reduce the efficiency of these production facilities.

## AIR QUALITY

Good air quality is essential for maximizing pig performance and air quality is directly related to the quantity of air exchange allowed through the facility. These facts suggest the need to ventilate at higher rather than lower exchange rates which would achieve some energy savings. Thus, the farm manager is required to manage the ventilation and heating systems to provide adequate ventilation; but, not over-ventilate.

## OVER-VENTILATING

Over-ventilating will waste either heat energy or feed energy. All phases of a typical swine enterprise should be equipped with some supplementary heat energy for Ontario's winter weather conditions. If this heat is not provided, the room environment either has to cool down or the air exchange rate has to drop significantly. Neither situation is beneficial as the pigs divert more of their heat energy to temperature maintenance or the air quality deteriorates substantially.

Table 1 shows the approximate supplemental heat required for a well-insulated building housing various groups of pigs and exchanging the minimum recommended quantity of air. Note that even breeding and gestation rooms should be equipped with a heater for outside temperatures lower than about -10°C. All-in, all-out grow-finish rooms require some supplementary heat until the pigs reach about 45 kilograms.

The bottom line is that all swine rooms should be equipped with some form of supplemental heat for the coldest portion of the year to maintain good air quality. But, one certainly does not want to waste any purchased heat. However, heat waste can and does occur very easily.

**Table 1. Supplementary heat requirements for swine rooms.**

| Pig Type and Size | Minimum Ventilation Rate | Outside Temperature -20°C | Outside Temperature -10°C | Outside Temperature 0°C |
|---|---|---|---|---|
| **Breeding/Gestation** | 10 CFM / pig | 500 BTU/h | 250 BTU/h | 0 BTU/h |
| **Farrowing** | 17 CFM / crate | 1000 BTU/h | 600 BTU/h | 200 BTU/h |
| **5 Kg Pigs** [a] | 1.3 CFM / pig | 225 BTU/h | 180 BTU/h | 130 BTU/h |
| **20 Kg Pigs** [a] | 2.5 CFM / pig | 50 BTU/h | 25 BTU/h | 0 BTU/h |
| **25 Kg Pigs** [b] | 3.0 CFM / pig | 200 BTU/h | 100 BTU/h | 0 BTU/h |
| **40 Kg Pigs** [b] | 4.0 CFM / pig | 110 BTU/h | 0 BTU/h | 0 BTU/h |

Source: OMAFRA Fanvent Analysis Program.
[a]Weaned pigs housed in a typical all-in, all-out nursery room.
[b]Pigs moved from nursery room to an all-in, all-out grow-finish room.

## REASONS FOR HEAT WASTE

There are several reasons for heat being wasted in a particular room. They include the following:

### Stage 1 fan is over-sized

If the minimum fan is over-sized and allowed to run continuously, more heat will be required to maintain the desired room temperature. The minimum operating speed for the fan may be set too high and cause over-ventilation. If the timer function is used, the settings may allow too much run time which also results in excessive ventilation.

### Stage 1 fan is correct size, but…

The minimum fan speed is set too high and allowing excessive ventilation. Many ventilation controllers have a minimum speed curve feature to automatically increase the stage 1 fan speed as the pigs grow. These curve settings may be too aggressive and allow excessive air exchange during cold weather.

### Heater shut-off temperature set too high

Since there is a certain amount of lag time for a temperature sensor to recognize the true temperature, the room temperature is generally still climbing when the heat does shut off. If the actual room temperature exceeds the set point temperature, the stage 1 fan will begin to speed up and exhaust extra air including the heat. Be sure the heater shuts off at least 0.3°C below the room set point temperature.

### Heater over-sized

Of course, most all heaters are over-sized for milder weather conditions, but using an over-sized heater based on winter conditions will cause excessive temperature over-shoot and more wasted heat.

## ELECTRICAL ENERGY UTILIZATION

Good ventilation system management is required to utilize electrical energy wisely and not waste it. I continue to see electrical energy wasted on many swine farms. I will discuss several common situations that I see on troubleshooting farm calls.

### Two Fans used for Stage 1 Ventilation

While many larger rooms do require two or more points of exhaust for minimum ventilation, most small rooms do not. Generally speaking, one point of exhaust is good for up to 40 or 50 feet of exterior wall length. Running two fans at a low speed when one running a little faster would suffice will save electrical energy, particularly when the stage 1 fans operate 24/7.

### Stage 2 Exhaust Fan(s) Allowed To Run Prematurely

Most all ventilation controllers will allow the relative set point for the stage 2 fan to be activated prior to the stage 1 fan reaching full speed. Even if the stage 2 fan is activated at the very instant that the stage 1 fan reaches 100% speed, electrical energy is wasted. Each stage of ventilation should be given a reasonable time frame to determine if that rate of air exchange is sufficient to control the room temperature. Only if the room temperature continues to climb higher should more ventilation capacity be added to limit the rate of temperature rise in the room.

Therefore, not only should each variable speed ventilation stage be allowed to reach 100% operating speed before additional ventilation capacity is added, there should be a small temperature rise allowed before the Stage 2 or subsequent fan stages operate. This small temperature differential between ventilation stages is often referred to as a "cooling deadband".

### Old Fans Versus New Fans

Fans more than 10 years old are not as efficient as today's models. It is not uncommon to find a new fan today that will deliver a similar quantity of air flow as the old unit while consuming 20% less electrical energy. For fan sizes, 24-inch diameter and less that operate a lot of hours each year, this saving can really add up. An example 18-inch diameter fan comparison is shown in Table 2. This energy use difference will be even more important once time-of-use billing is initiated later in 2011.

**Table 2. Fan energy use comparison.**

| 18" dia. Fan | Amperage Draw | Voltage | Power | Power Consumption |
|---|---|---|---|---|
| **Old Fan** | 2.0 A | 240 V | 480 watts | 0.480 Kw / hr |
| **New Fan** | 1.6 A | 240 V | 384 watts | 0.386 Kw / hr |
| **Difference** | 0.4 A | | 96 watts | 0.096 Kw / hr |
| **For 7200 hr / yr** | | | | 691.2 Kwh |
| **Savings @ $0.13 / Kwh** | | | | $89.86 / yr |

## VENTILATION EQUIPMENT MAINTENANCE / MANAGEMENT

Of course there are a host of other little details that should be done on a routine basis to ensure the ventilation and heating system is working as efficiently as possible. These include;

- Keep fans and temperature sensors clean.
- Service heating units every year or more often if necessary.
- Use insulated covers in winter to reduce heat loss through the summer fans.
- Ensure the building insulation is in place and doing its job. In this regard, a good rodent control program is very important.
- Measure the air quality regularly.
    - Ammonia level < 20 ppm (≤ 15 ppm is better)
    - Relative Humidity < 70% (60 to 65% better)
- Ensure the ventilation controller settings are appropriate for each type and size of pig being housed.

# ENERGY AND VENTILATION MANAGEMENT ISSUES IN U.S. PIG BUILDINGS

**Larry D. Jacobson**
**Professor and Extension Ag Engineer**
**Dept of Bioproducts & Biosystems Engineering**
**University of Minnesota**
**1390 Eckles Ave., St. Paul, Minnesota, 55108**
**E-mail: jacob007@umn.edu**

## ABSTRACT

A recently completed Minnesota / National Pork Board (MPB/NPB) funded project entitled: Reducing the Environmental Footprint of Swine Buildings (Jacobson, et al., 2011), had the requirement to provide retrofit or remodeling guidelines to reduce energy use and the amount of air emissions for pig finishing buildings presently being used in the Midwestern U.S. Barn retrofit concepts reported in this document focus on structural upgrades such as insulation and mechanical items like improved environmental control, fan and heater maintenance and management, along with manure pit management. Also included are more extensive suggestions to improve pig performance through more effective cooling systems since most production losses due to poor housing systems occur during warm ambient conditions.

## INTRODUCTION

A large majority (≥ 85%) of the pig finishing buildingspresently being used in the Midwestern U.S. to grow pigs are either the curtain sided (CS) or the tunnel ventilated (TV) barn. The CS barn (Figure 1), as the name implies, typically has vinyl curtains on both long sidewalls which are adjusted with a temperature controller to provide ventilation or air exchange in the barn during warm and some cool weather conditions. During cold weather, the sidewall curtains are closed up completely and the barn is mechanically ventilated by pit and possibly one or two end wall fans plus designed ceiling inlets. The typical mechanical ventilation fan capacity for a CS barn is from 20 to 25 cubic feet of air per minute per pig (cfm/pig).

**Figure 1**
**Typical Curtain Sided (CS)**
**Pig finishing barn.**

The TV barn (Figure 2) is mechanically ventilated year around with total fan capacities generally at 120 cfm/pig that is divided between pit fans (~20 cfm/pig) and tunnel or wall fans (~100 cfm/pig). These barns have solid insulated sidewalls and one end that contain the large diameter "tunnel" exhaust fans while the other end has an adjustable vinyl curtain. During the winter the curtain end wall is completely closed and all the air is brought in through designed ceiling inlets that draw air from the barn's attic (similar to the CS barn). In the summer, the end wall curtain opens as needed by the number of operating tunnel fans at the opposite end of the barn. During warm temperatures most of inlet air comes through the end wall curtain with some entering through the ceiling inlets.

**Figure 2**.
**Common Tunnel Ventilation (TV) pig finishing barn.**

## DISCUSSION

### Options for Reducing Energy

Several publications and reports address energy use in swine production. These publications can be found on-line and in many trade journals. The following are the most common practices and considerations found supplemented with additional information developed by our project. Note that most of the ideas presented below relate to the heating and ventilation systems as these systems represent an estimated 70% of energy use in a finishing building (Brodeur, 2008).

*Fan Maintenance*

As has been the focus of many extension publications and producer workshops, proper fan maintenance can have an impact on energy use. Cleaning fans and especially shutters on a routine basis will allow the fans to operate at maximum efficiency. Belt driven fans should be closely monitored for belt slippage.

*Fan Efficiencies*

In general, small fans are less energy efficient (cfm/watt) compared to larger capacity fans (Figure 3). Because of this,

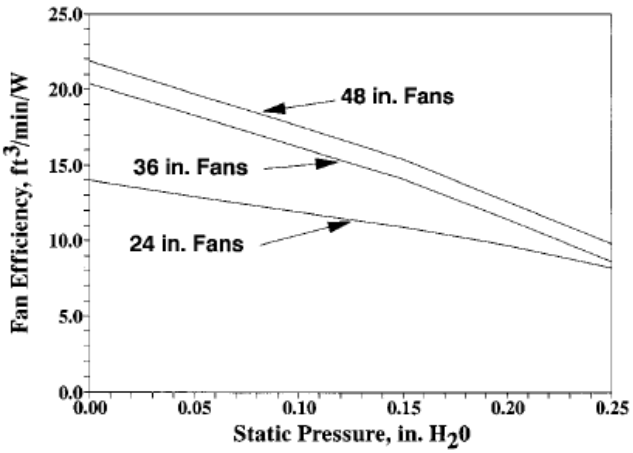


**Figure 3**. **Graph of typical fan efficiencies. (ASAE EP566.1).**

ventilation control systems should limit operation of minimum ventilation fans (smaller fans) during periods of higher ventilation requirements. Also, variable speed fans should be operated at full speed whenever possible as fan efficiencies are highest at full power (when operated at 100%). Frequency drive motors for fans are gaining popularity as they are much more efficient when run at less than 100% capacity.

*Minimum Ventilation*

Make sure minimum ventilation fans are sized to provide the minimum or continuous air exchange rate. Over ventilation during cold weather will increase furnace run-times and fossil fuel use. However, remember that maintaining minimum ventilation is essential for providing a healthy environment for pigs and workers. Small nursery pigs (15 lbs) require a minimum ventilation or air exchange rate of 2 cubic feet of air per minute (cfm/pig) while large finishing pigs (200+ lbs) require approximately 10 cfm/pig.

*Controller Set points*

Temperature setpoints or targets on controllers that regulate barn heaters and ventilation fans can have a dramatic affect on energy use. Optimum temperatures for pigs from 12-30 lbs are between 85-75°F while pigs between 30-75 lbs require temperatures between 75 and 70°F and temperatures between 70 and 55°F for pigs between 75-265 lbs. Often this setpoint temperature control is based on one or two sensory locations in the barn. A check should be made to determine if the environmental control system is indeed providing proper temperatures throughout the barn. A degree or two different temperature setpoints can significantly impact heater run-time and fuel use. Figure 4 shows estimates of fuel use and electrical use with changes in temperature setpoints. Note that decreases in temperature setpoints result in decreased fuel consumption (winter) and increased electrical consumption (summer). Additionally, the controller's setpoints for heaters, inlets, and ventilation fans should be synchronized properly to produce acceptable static pressure ranges in the barn and prevent "heater overshooting" that causes unnecessary cycling of the heater and excessive fossil fuel use.

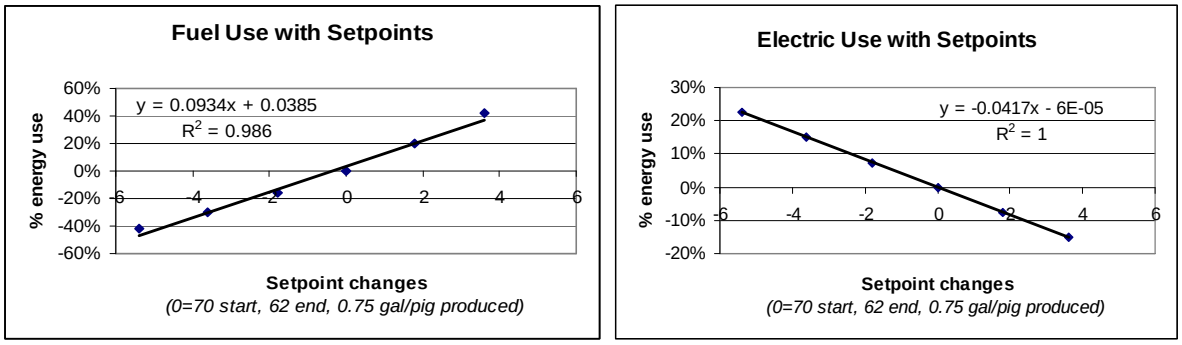


**Figure 4. Model predictions for fuel use based on changes in setpoint for a typical 2800 hd, mechanically ventilated swine finishing barn in West Central MN.**

*Heaters*

Heaters are often over sized to insure adequate heating capacity to maintain room temperatures during cold weather. However, this over-sizing often results in the overshooting of temperature setpoints and more frequency cycling of the second stage ventilation fans. The temperature when the heater comes on should be at least 2°F below the ventilation setpoint. Radiant heaters

offer an advantage over direct-fired combustion furnaces because they heat surfaces rather than the air. In general, radiant heaters will reduce total barn energy use by as much as 50% since it heats strategic "zones" such as the solid floor for weaned pigs rather than the whole barn.

*Insulation and draft reduction*

Reductions in winter heating can also be achieved by reducing any drafts (undersized air inlets) in the barn from leaky curtains or fan openings. Insulating curtains and summer fan openings with bubble wrap, although requiring some initial investment and seasonal labor will tighten up the barn substantially and result in heat and fossil fuel savings. Barns with poorly insulated sidewalls such as un-insulated concrete and curtains may only have an average R-value of 1. Increasing the R-value to 2, 5 and 10 (as estimated by the Danish StaldVent pig housing/growth model (Morsing, et al., 1997) for central Minnesota) results in fuel savings of 30% and 50%, and 65% respectively. Smaller saving would occur in warmer climates.

*Prevent wind pressure on the fans*

Wind pressures against the exhaust fans result in reduced fan efficiency and over or under ventilation of the building. With a typical barn operating static pressure of 0.1 inches of water, wind speeds of 15 mph would reduce fan output to nearly 0 cfm. These wind pressures result in under-ventilation and more fans running to meet the temperature setpoint requirements. Wind pressures can be reduced with the use of fan baffles (Figure 5) and cones or by having fans exhaust vertically through the ceiling and roof. Also, for tunnel ventilated barns, an east/west vs. north/south layout is more desirable since the east/west orientation has the large tunnel fans facing east rather than south which is the common summer wind direction in the Midwest. Operating at a higher static pressure will also reduce this effect but decreases energy efficiency.

**Figure 5. Fan baffle.**

**Guidelines for energy saving plus ventilation management in either CS or TV barns**

The use of "bubble wrap" insulation, as shown in Figure 6, can be helpful to insulate and also seal curtain side or end walls during cold weather operation. This will save conductive heat loss and L.P. Gas usage, plus it will prevent frosting and excessive condensation on the inside curtain surface and tighten up the barn so inlet air will enter the barn through the design inlets rather than undersigned openings around the curtains.

Insulate any concrete knee side or end walls that are not presently insulated. This is best done on the outside with at least 2 inches of rigid board insulation. This will prevent conductive heat loss and thus L.P. Gas usage plus prevent frosting and most condensation on the inside kneewall surface.

**Figure 6**.
**Bubble wrap placed on inside of curtain with aluminum side on the inside.**

Insulate the warm weather exhaust fans with an insulated cover placed over the inside louvers. This will reduce conductive heat loss plus more importantly prevent backdrafting of cold air through the warm weather fan louvers. Also, place a fan "sock" on the outside of any non-continuous running fans that will operate during cold weather to prevent backdrafting of air when these fans are not operating.

Relocate pit exhaust fans to side or end walls to eliminate pit exhaust fans (Figure 7). This will reduce gas and odor emissions while still maintaining indoor air quality as long as similar air exchange or ventilation rates are maintained.

**Figure 7**.
Pit fan has been moved to sidewall.

Pump manure from the deep pit twice a year instead of once. This management practice will prevent the manure level in the deep pit from becoming too high (goal is to keep three feet of freeboard below slats) which will reduces air emissions especially if pit fans are used.

Change L.P. Gas heater setting on controller to prevent heater overshoot (temperature in room continues to rise in barn after heater shuts off and triggers first stage ventilation fans to come on). The shut off temperatures for heater should be at least 2$^{o}$F under the controller "setpoint" temperature. Also, make sure the controller's temperature sensors are placed well away from heated furnace jet airstream and are sensing a true room temperature. Preventing heater overshoot will save large amounts of L.P. Gas.

Change L.P. Gas heaters setting to low (most direct fired heaters will have a low and high setting) which will also save L.P. Gas usage since very often heaters are oversized in pig finishing barns. Ventilation performance will be improved (less temperature variations) since heaters will run longer but use less L.P. Gas and allow building to respond and prevent "heater overshoot". Typically heaters only need to be switched to the high setting when there are only young pigs in barn (wean to finish) or after power washing.

When selecting fans for the minimum or continuous ventilation rates in the winter, select the fewest number of exhaust fans possible and if possible only use single speed fans that can be manually operating (hot-wired or not part of controller). However, if variable speed fans are used for providing this rate, they should never run under 50% rpm, since they do not provide a reliable airflow rate and are energy inefficient at or below that speed. Energy and ventilation efficiencies will be improved when single speed fans are used to provide the minimum ventilation rate rather than using variable fans.

**Guidelines for energy saving plus ventilation management in only CS barns**

If the mechanical ventilation capacity for a CS barn is only 20 or 25 cfm/pig consider increasing it to 40 or 45 cfm/pig. This will require the installation of an additional exhaust wall fan or two plus corresponding additional ceiling and attic inlets. Such an increase in the ventilation rate, will allow the mechanical ventilation season for the barn to be extended to later in the fall and spring so the sidewall curtains will not need to operate when there are cold ($\leq 30^{o}$F) ambient temperatures. Although there will be increased use of electrical energy for the additional fans, there will be less L.P. Gas usage due to the over ventilation of barn that almost always occurs when curtains are operating during cold outside temperatures.

The sidewall curtains in a CS barn should have over-lap of at least 3 inches to prevent leakage of air during winter conditions. An annual check of the curtain cables is required for CS barns to account for possible cable stretching.

**Guidelines for additional cooling in either CS or TV barns**

Nearly all CS and TV finishing barns in the Midwest have sprinklers installed with timers (common to run them 1 or 2 minutes out of 10) and ceiling mounted circulation fans above pens to increase evaporation from the pigs, whenever inside room temperatures reach a threshold. To maximize pig cooling and prevent feed intake reduction and growth, the room temperature when these direct "on the pig" evaporative cooling is initiated should begin at roughly 80 F when pigs are small (50 lbs) and decreased proportionally to approximately 70 F when pigs are > 230 lbs.

Although common in sow gestation and farrowing buildings, consider adding evaporative cooling pads in TV pig finishing barns. The tunnel exhaust fans selected for an evaporative cooling pad TV barn must include the added pressure drop that the cooling pad will add to the ventilation system.

Another room cooling practice that can be used in either CS or TV barns is directly evaporative "misting" of the air as it enters either of these buildings through the sidewall or endwall curtains respectively. Direct misting is being done with high pressure lines and nozzles that create a mist or fog that evaporates in and cools down the incoming ventilation air. This might be best used in the TV barns but could also have application in CS barns, especially on the prevailing summer wind direction side (typically south in the Midwest). The activation time for these misting systems would be similar to those given above in pen sprinkler systems, namely 80 F when pigs are small (50 lbs) and decreased proportionally to approximately 70 F when pigs are > 230 lbs.

## CONCLUSIONS

Barn retrofit concepts reported in this paper focus on structural upgrades such as insulation and mechanical items like improved environmental control, fan and heater maintenance and management, along with manure pit management.

Moving the swine industry forward in more sustainable pig production was the primary focus of this project. Results from the project indicate that current facilities can be modified or managed to reduce energy inputs. Results also indicate that there are alternatives to the current pig finishing facilities that could result in reduced energy and emissions per pound of meat produced while still being economically viable.

## ACKNOWLEDGEMENTS

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# LOOKING BEYOND PRODUCTION BENCHMARKING

**Justin Roelofs**
**AgStar Financial Services, ACA**
**1921 Premier Dr, Mankato, MN 56001**

## INTRODUCTION

Many production systems look to measure their performance against benchmarks provided by industry specialists and university studies. This information can be very useful when put in the correct context and compared properly to any given producer's production system. If a production system *continuously* compares and measures its processes against those of industry leaders it will be able to improve those processes and become a lower cost producer.

So how can a producer utilize this information and what kind of production statistics are top US producers seeing today?

## UNDERSTANDING PRODUCTION VARIABLES

Before one can begin to compare their production system to others, you need to truly understand your cost structure and how costs tie to your current production processes and statistics. Consistent and accurate production data and financial records are key in compiling the information needed to begin benchmarking production.

## 2010 AVERAGE US PRODUCTION COSTS

The average US producer could produce a 270 lb hog for between $140-$145 in 2010. Going forward, to raise that same animal at the same weight with current feed costs, it will cost an additional $25 per head. These numbers change quickly, given the volatility in the grain markets, and one must be careful in comparing costs because of the regional differences in production. Regional differences aside, the lowest cost producers will still win, in the long run. Conversely, if one operates in a region that cannot formulate low cost feed diets or competitive production it will be difficult to stay in business.

## STATISTICS SEEN IN LOW COST US FARROWERS

The top *25%* of US farrowing operations, in terms of cost, averaged $30 in 2010. Those same producers averaged better than 12% pre-wean mortality and better than 25 pigs per/mated sow/year along with farrowing rates around 90%. The top variables influencing low cost producers appear to be pre-wean mortality and non-productive days.

In terms of the average producer we see better than 23 pig pigs per/mated sow/year with costs in the mid $30s.

## STATISTICS SEEN IN LOW COST US FINISHERS

The top variables influencing low cost production appear to be mortality along with a higher number of grade A sales or low number of cull sales. The top *25%* of US finishing producers consistently market 2% or less culls and have wean-to-finish death loss in the area of 4%. These factors help them produce a much more consistent animal, which helps in maximizing their revenue by consistently hitting their packer's matrix.

Feed costs can vary wildly given producers' different risk management strategies. Outside the direct feed input costs, such as corn and soybean meal, the low cost producers are on the cutting edge when it comes to diet composition. Low cost producers tend to be those who are willing to utilize all available feed ingredients to formulate the most economically competitive diets and review those diets on a regular basis. The lowest cost, from a feed perspective, may not necessarily mean the highest profitability as a producer's margin could improve, even with increasing feed costs. Risk management is critical in managing this aspect of production.

## A LENDER'S VIEW ON BENCHMARKING

If a producer can show where their operation stands and what they are doing to continually improve operations this will strengthen their relationship with their lender. Providing accurate and timely production data and tying this to their financial performance will greatly improve their risk management program and will accelerate any request for funding.

## CONCLUSION

The data exists for producers to compare their operations not only to the rest of the industry, but to the top producers in their industry. This information can help the prepared producer improve processes and continually drive down costs of production. Those who are students of every aspect of their business and continually strive to improve production through benchmarking will continue to lead the industry to new heights.

# LOOKING BEYOND PRODUCTION BENCHMARKING

**Randy Duffy**
**University of Guelph, Ridgetown Campus**
**120 Main St. East, Ridgetown, Ontario, N0P 2C0**
**E-mail: rduffy@ridgetownc.uoguelph.ca**

## ABSTRACT

Benchmarking can be a valuable tool. A producer can benchmark themselves against other pork producers in Ontario or producers in other provinces, countries or commodities. It can be as informal as a casual discussion with another producer or as formal as an organized group that meets periodically. The process allows a producer to measure their operation and identify areas to improve in. Benchmarking is a continual process.

## INTRODUCTION

Benchmarking can be overwhelming due to the number of data variables that potentially could be analyzed and the number of data sources available for comparison (e.g. Statistics Canada, OMAFRA, USDA, etc.). It is important to look at both production and related financial variables to obtain a more complete picture of the time period you are examining. This paper will highlight some potential benchmarks from the Statistics Canada Canadian Farm Financial Database and some research completed by University of Guelph, Ridgetown Campus.

## PRODUCTION BENCHMARKS

One method of benchmarking involves comparing your operation to other producers in Ontario. Table 1 shows pigs born alive per litter, weaned per litter and the implied preweaning mortality for Ontario from 2008 to 2010. These figures have been calculated using data from Statistics Canada. A variable that every producer tracks is pigs weaned per litter. This number has increased from 9.43 in 2008 to 9.54 in 2010.

**Table 1. Ontario production variables based on Statistics Canada data.**

| Variable | Period | | |
|---|---|---|---|
| | **2008** | **2009** | **2010** |
| Born alive/litter | 10.47 | 10.52 | 10.54 |
| **Weaned/litter** | **9.43** | **9.46** | **9.54** |
| Preweaning mortality (%) | 9.9 | 10.0 | 9.5 |

Source: Statistics Canada, CANSIM 30004, 30087 and 30088.
Notes: Based on average of four quarters. Numbers have been rounded.

University of Guelph, Ridgetown Campus has been conducting a farrow to finish benchmarking study called the Ontario Data Analysis Project (ODAP) for 20 years. Participants provide production and financial data and in return receive a personalized farm analysis that compares their farm business to the group average and top half of producers. It is believed that the results are fairly typical of a farm that has about 100 to 500 sows.

ODAP results are on a "pig produced" basis and this reflects the number of market hog equivalents produced on the farm taking into account all production and inventory changes. In 2009 the average ODAP participant had 233 sows and produced 4,865 pigs. In the swine enterprise, total revenue was $118.49/pig produced, not including government payments, and expenses were $144.40 resulting in a loss of $25.91/pig produced. Expenses related to family labour were not included. Figure 1 provides a historical depiction of average revenue, expenses and profit over time for ODAP and highlights the variability at the farm level.

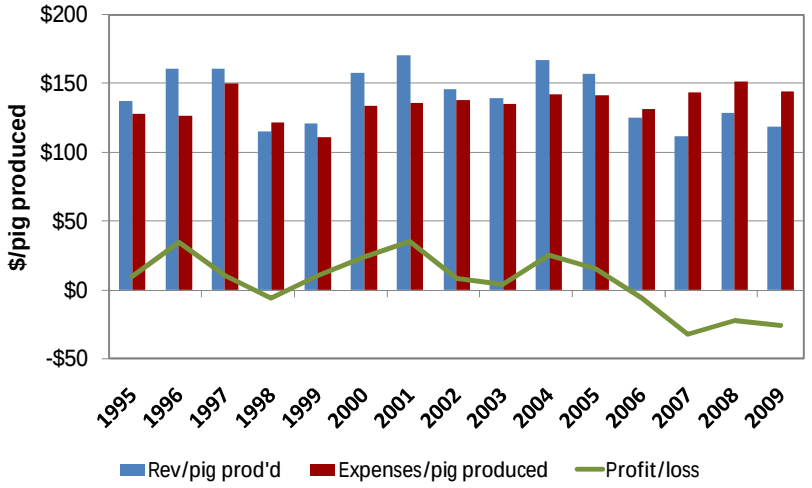


**Figure 1. Historical ODAP profit per pig produced ($).**

Table 2 shows selected production data for the ODAP participants for the 2001-2005 average, 2006-2009 average and the top 50% of participants for the 2006-2009 period. The top 50% is based on net farm income per pig produced. The difference between the group average and the top 50% average is also shown for the 2006-2009 period. Looking at productivity during the 2001-2005 period compared to the 2006-2009 period average, shows that pigs born alive per litter, weaned per litter, weaning age and weaning weight have all increased. However, nursery and grow-finish mortality rates have also increased.

**Table 2. ODAP production variables.**

| Variable | Period | | | Difference |
|---|---|---|---|---|
| | 2001-05 Avg | 2006-09 Avg | 2006-09 Top 50% | 2006-09 Top 50% vs Avg |
| Number of sows | 237 | 222 | 216 | -6 |
| Total Crop Acres | 353 | 423 | 404 | -18 |
| Litters/sow/year | 2.29 | 2.27 | 2.31 | +0.04 |
| Born alive/litter | 10.75 | 11.03 | 10.99 | -0.04 |
| Weaned/litter | 9.43 | 9.68 | 9.66 | -0.02 |
| Weaning age (days) | 21.8 | 23.5 | 24.1 | +0.5 |
| Weaning weight (kg) | 6.55 | 7.15 | 7.23 | +0.08 |
| **Preweaning mortality (%)** | **12.2** | **12.1** | **12.0** | **-0.1** |
| **Nursery mortality (%)** | **2.4** | **3.8** | **2.9** | **-0.9** |
| **Grow-Finish mortality (%)** | **2.3** | **3.5** | **2.7** | **-0.7** |
| Pigs weaned/sow/year | 21.6 | 21.9 | 22.1 | +0.2 |
| **Marketings/sow/year** | **20.4** | **20.4** | **21.5** | **+1.1** |
| Pigs produced/sow/year | 17.7 | 18.9 | 18.8 | -0.1 |

Notes: Top 50% based on net farm income/pig produced. Numbers have been rounded.

A comparison of the 2006-2009 top 50% to the group average showed that born alive per litter, weaned per litter and weaned per sow per year are similar. The top 50% did have an advantage though in nursery mortality, grow-finish mortality and marketings per sow per year (i.e. all piglet, feeder and market hog sales).

## FINANCIAL BENCHMARKS

It is always interesting to look at production benchmarks but it is important to also look at the associated financial data. A key question here is to what extent does cost control trump productivity? Table 3 shows selected ODAP financial variables for the same groups as in Table 2. This is where the difference between the top 50% and the group average for the 2006-2009 period is most apparent. While Table 2 showed similar production data for the top 50% and group average in 2006-2009, Table 3 shows that the top 50% averaged $3.36 higher in revenue per pig produced and also averaged $15.18 less in expenses per pig produced. This resulted in a net farm income per pig that was $18.53 higher. Another key number in this table is the feed cost difference of $7.30 per pig.

**Table 3. ODAP financial variables.**

| Variable ($ / pig) | Period | | | Difference |
|---|---|---|---|---|
| | 2001-05 Avg | 2006-09 Avg | 2006-09 Top 50% | 2006-09 Top 50% vs Avg |
| **Revenue** | **156.84** | **121.49** | **124.85** | **+3.36** |
| **Feed** | **87.89** | **95.13** | **87.84** | **-7.30** |
| Health | 5.14 | 5.05 | 4.18 | -0.87 |
| Interest | 8.25 | 8.62 | 5.56 | -3.06 |
| Depreciation | 15.51 | 16.19 | 13.21 | -2.98 |
| **Total expenses** | **140.47** | **144.95** | **129.77** | **-15.18** |
| **Net farm income** | **16.37** | **-23.46** | **-4.92** | **+18.53** |
| Total assets ($ / sow) | 11,623 | 13,209 | 11,876 | -1,333 |
| Total debt ($ / sow) | 3,690 | 4,248 | 3,462 | -787 |
| Debt : Assets | 0.33 | 0.38 | 0.34 | -0.04 |
| Debt : Equity | 0.61 | 0.81 | 0.68 | -0.13 |
| ROA (%) | 4.6 | -2.2 | -0.1 | +2.1 |
| ROE (%) | 5.1 | -8.2 | -3.3 | +4.9 |

Notes: Top 50% based on net farm income/pig produced. Figures are accrual basis. Numbers have been rounded. ROA = Return on Assets; ROE = Return on Equity

The top 50% group had less assets and debt per sow along with a 2.1% higher return on assets and a 4.9% higher return on equity.

## COMPETITIVENESS OF ONTARIO VS. MANITOBA AND QUEBEC

Another method of benchmarking involves comparing Ontario industry data to producers in other provinces in Canada. Financial data is more readily available for other provinces than production data. Therefore, this section will only discuss financial benchmarks. Data is from the Statistics Canada Canadian Farm Financial Database.

Table 4 shows selected income statement variables for Ontario, Manitoba and Quebec for the 2001-2005 and 2006-2009 period averages. Both pig sales and total operating revenues show that the average Ontario farm tends to be smaller than those in Manitoba and Quebec. However, net operating income for the 2006-2009 period is similar across the provinces. Net operating income is calculated as total operating revenues minus total operating expenses and excludes capital cost allowance, the value of inventory adjustments and other adjustments for tax purposes. It is also described as the sum of net market income and net program payments. Net

operating income as a % of total operating revenues showed that Ontario (6%) was slightly higher than Quebec (5%) and Manitoba (3%) for the 2006-2009 period.

**Table 4. Ontario, Manitoba and Quebec income statement variables, all hog farms.**

| Variable ($'000 / farm) | Province | | | | | |
|---|---|---|---|---|---|---|
| | Ontario | | Manitoba | | Quebec | |
| | 2001-05 Avg | 2006-09 Avg | 2001-05 Avg | 2006-09 Avg | 2001-05 Avg | 2006-09 Avg |
| Farms (number) | 2,048 | 1,438 | 789 | 491 | 1,860 | 1,655 |
| Pig sales | 472 | 606 | 1,162 | 1,715 | 712 | 753 |
| Crop sales | 33 | 59 | 91 | 119 | 16 | 20 |
| **Feed expense* (%)** | **40** | **45** | **41** | **48** | **43** | **53** |
| Total operating revenues (TOR) | 561 | 773 | 1,383 | 2,109 | 853 | 1,040 |
| Total operating expenses | 506 | 725 | 1,231 | 2,046 | 792 | 991 |
| Net operating income (NOI) | 55 | 48 | 152 | 63 | 61 | 49 |
| **NOI/TOR (%)** | **10** | **6** | **11** | **3** | **7** | **5** |
| Gross income for tax purposes | 585 | 820 | 1,417 | 2,160 | 892 | 1,081 |
| Total expenses for tax purposes | 565 | 803 | 1,348 | 2,193 | 873 | 1,074 |
| Net income for tax purposes | 21 | 17 | 69 | -33 | 19 | 7 |
| **Net income/Gross income (%)** | **4** | **2** | **5** | **-1** | **2** | **1** |

Source: Statistics Canada, Taxation Data Program, Canadian Farm Financial Database.
Notes: *Expenses are calculated as a % of pig sales. Numbers have been rounded.

After capital cost allowance, the value of inventory adjustments and other adjustments for tax purposes are accounted for, gross income for tax purposes still shows Ontario farms on average are smaller. However, estimated net income for tax purposes shows that Ontario (17) fared better than Manitoba (-33) and Quebec (7) during the 2006-2009 period.

It should also be pointed out that feed expenses as a % of pig sales showed Ontario to be lower than Manitoba and Quebec for both periods. For example, during the 2006-2009 period, feed costs for Ontario averaged 45% of pig revenues while Manitoba's figure was 48% and Quebec's was 53%.

Table 5 shows selected balance sheet variables for Ontario, Manitoba and Quebec for the 2001-2005 and 2006-2009 period averages. Note that the figures in Table 5 do not correspond precisely with the data from Table 4 due to the slightly different set of farms represented. For example, the average number of farms represented in Table 4 for Ontario in the 2006-2009 period is 1,438 while the number of farms in Table 5 for Ontario in the same period is 1,455.

However, it gives a good representation of Ontario's relative position compared to Manitoba and Quebec.

**Table 5. Ontario, Manitoba and Quebec balance sheet variables, all hog farms.**

| Variable ($'000 / farm) | Province | | | | | |
|---|---|---|---|---|---|---|
| | Ontario | | Manitoba | | Quebec | |
| | 2001-05 Avg | 2006-09 Avg | 2001-05 Avg | 2006-09 Avg | 2001-05 Avg | 2006-09 Avg |
| Number of farms | 1,802 | 1,455 | 635 | 451 | 1,620 | 1,436 |
| Assets | 1,493 | 1,921 | 2,361 | 3,477 | 1,302 | 1,349 |
| Liabilities | 485 | 709 | 592 | 1,090 | 564 | 611 |
| Net Worth | 1,007 | 1,212 | 1,768 | 2,387 | 738 | 738 |
| Land & buildings | 1,026 | 1,405 | 1,294 | 2,103 | 782 | 861 |
| **Current ratio** | **2.34** | **1.99** | **3.43** | **2.43** | **1.99** | **1.65** |
| Debt structure | 0.16 | 0.16 | 0.20 | 0.18 | 0.16 | 0.21 |
| Debt : Assets | 0.33 | 0.37 | 0.25 | 0.31 | 0.43 | 0.45 |
| **Debt : Equity** | **0.48** | **0.60** | **0.34** | **0.46** | **0.76** | **0.83** |
| **Land : Liabilities** | **2.12** | **2.02** | **2.17** | **1.95** | **1.39** | **1.41** |

Source: Statistics Canada, Farm Financial Survey, Canadian Farm Financial Database.
Notes: Numbers have been rounded. Current ratio = current assets divided by current liabilities; Debt structure = current liabilities divided by total liabilities.

Table 5 shows that in terms of asset values, Manitoba farms are the largest while Quebec's farms are the smallest with Ontario in the middle. Both asset values and liabilities have increased from the 2001-2005 to 2006-2009 periods in all three regions. The result is that net worth has increased in Ontario and Manitoba but was unchanged in Quebec. This means that asset values in Ontario and Manitoba have increased at a greater pace than liabilities. The majority of assets are in land and building values. This has been important during the 2006-2009 period as some producers have had to access additional credit and the increased value of land has provided collateral to do this. Of note in Table 5 is the ratio of land and building values to total liabilities. Ontario has a higher ratio (2.02) for the 2006-2009 period than both Manitoba (1.95) and Quebec (1.41).

Another important ratio is debt to equity. This ratio has increased in all three regions from the 2001-2005 to the 2006-2009 periods. Ontario's ratio averaged 0.60 in 2006-2009 which is in the middle compared to Manitoba (0.46) and Quebec (0.83).

In summary, Tables 4 and 5 show that Ontario producers as an industry are very competitive financially with producers in Manitoba and Quebec.

## THINGS TO CONSIDER

Many questions may arise when attempting to benchmark your operation. Some of these include:

- How to get started?
- Who to benchmark against?
- What variables to measure?
- What time period to look at?
- What definitions to use to calculate a specific variable? If you are a member of a benchmarking group, this question is an important one because all the members should be using consistent definitions so figures are comparable and trends over time can be tracked.

## CONCLUSIONS

Some key points about benchmarking:

- Keep things simple. Unless you like dealing with lots of data try to measure a few key variables for your operation.
- Be consistent in how you measure something. This allows for comparisons within your own system and over time.
- A good place to start is looking at the average. If you have access to detailed data, look at the low and high values. A standard deviation value allows you to calculate (i.e. average +/- 1 standard deviation) a range that represents where 67% of producers are at.
- Find out the story behind the numbers. This is the real value in benchmarking groups. Members can ask each other how they achieved a certain number, things that worked well and things that didn't work so well.
- Productivity is important. Increased productivity allows for certain costs (e.g. interest, depreciation, etc.) to be allocated over more units.
- Cost control trumps production. The farm's bottom line is what you are most interested in.

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# IMMUNOCASTRATION IN SWINE: A PRACTICAL APPROACH

**Augusto Heck**
**Swine Specialist**
**BrasilFood's Corporative Office**
**39 Saul Brandalise St., Downtown, Videira, SC, Brazil 89.560-000**
**E-mail: augusto.heck@brasilfoods.com**

## ABSTRACT

To succeed in adopting the immunocastration process it is necessary to be alert to a series of components within and outside the pork production system. From the regulatory environment, slaughterhouses, veterinary pharmacies, farms, labor through to the final consumer should be considered when evaluating and routinely using this tool. Prior to routinely adopting the technique, analyses should include environmental legislation, slaughterhouses and farm structure and work routine, veterinary pharmacies, manpower and the final consumer.

## INTRODUCTION

Immunocastration in pigs is a new technology that is being increasingly adopted worldwide, on a day by day basis. For those who do not have all the information about this technique it seems to be like any other vaccination process, but it is much more than this. The aim of this article is to share the Brazilian experience that our country and, especially, our company, is having in adopting this technique.

## VACCINATION TEAM

### 1. Attraction and selection of people

The vaccination team is a crucial part for the successful adoption of immunocastration. Given the complexity of questions to be observed it is suggested to recruit agriculture technicians due to their training and vocation. It is important to have a career plan for them, with the possibility of use of such team members in the technical assistance for farmers in client companies.

### 2. Training and capacity building

It is important that those involved in the task have the knowledge of male physiology and ethology as well as semiology. They need to understand how the tool works, how to apply it and what are the expected and unexpected results. It is also important to share with them concepts of ergonomics and gymnastics at work as well defensive driving.

### 3. Productivity and efficiency

There are differences in the skill level for each task among team members. Nevertheless, it is necessary to do the job rotation to avoid fatigue and minimize the risk of accidents. The team size should consider clearances and daily work journey not too long. A key aspect in the optimization of resources is the correct setting of the weekly work schedule.

### 4. Tasks and functions

There are several items: preparation of the schedule, driver, inventory management, cleaning and maintenance of equipment, preparation of doses in syringes, restraint of animals, product application and inspection for the need of the third dose.

### 5. Personal protective equipment

For the protection of employees and due to the labor laws it is necessary to wear dust masks, noise dampers, gloves, waterproof disposable pens and hard protection from the knees to the ankles and boots. The uniform should be comfortable and compatible with the climate of the region.

### 6. Controls and assessment points

Temperature of vaccines in storage equipment, number of applied doses, incidence of local reactions, abscesses and needle breakage are the main monitoring items.

### 7. Accidents

Field experience suggests that the risk of self-injection is small. Although no direct studies on humans have been conducted, extensive animal studies and scientific knowledge about this type of product suggest that a single injection will have no major clinical effect beyond any pain and injury associated with the injection itself. A single injection, however, may prime the immune system to react to subsequent injections, in the same way it does in the pig. As a precaution it is suggested that the person should be removed from the task of handling / applying the product (Improvac FAQ´s website**)**.

## FARMS AND PRODUCTION SITES

### 1. Loading strategy

Sexed accommodation facilitates the work because it reduces the number of sites to be visited for the application. This could, as an inconvenience, increase the number of sources of piglets to make a batch.

**2. Site and time of the first dose**

It is possible to apply the first dose of the product already in the nursery phase until the finishing phase. This flexibility allows adaptation to different realities of production structure. There is no performance difference in choosing the different moments of the first dose.

**3. Infrastructure for animal containment**

It is essential that the stalls and walls allow the use of the boards for management to separate the animals that will receive the vaccine from the others that already received. This greatly facilitates the workflow within pens.

**4. Quality control**

Producers are recommended to conduct weekly inspections of all immunized animals at around two weeks after the second dose. The aim is to detect any animal which may not have been successfully immunized. Testicle size and appearance are excellent visual indicators of a successful immunocastration. Testicles are generally a half to one-third of the size of those of a non-immunized boar, and less prominent in the scrotum. Signs of large, reddened testicles or repeated/ prolonged mounting and thrusting indicate sexual activity and suggest that the pig may not have been given one of its two doses. These animals should be given an additional dose straightaway (Hennessy, 2006).

**5. Abscesses**

Like any injectable product, the risk of occurrence of abscesses exists. The application site and the depth in which it presents are characteristic. Usually its occurrence is associated with the application in non-hygienically raised animals.

## VETERINARY PHARMACY

**1. Cooling structure**

The refrigerator must be capable of generating cold enough to meet demand considering the frequency of delivery plus a margin of safety. It must have an electronic system for reading and recording temperature and, depending on size, an alarm system with automatic phone call plus a stationary fuel powered electric energy generator for backup purposes on power outages.

**2. Different number of doses per bottle**

To avoid waste of product due to the difference between number of doses versus number of animals at field; and the potential risks associated with the breakdown of farm biosecurity policies by sharing products; it is important to purchase more than one size of bottle to match more precisely what was planned with what will be carried out.

### 3. Contingency stock

According to the lead time of the product and risks related with the discontinuity of supply it is necessary to have an agreement between customer and supplier to ensure a safety stock for contingencies.

### 4. Special syringes

The applicator should be safe, functional and durable. It must be constructed to minimize the risk of injury or self-application, and must be comfortable to use for long periods. The use of bottle rack attached to the body gives a good autonomy between refilling. The equipment with two stages of pressure to dispense the product is very safe. There is a possibility of using automated systems to gain in number of vaccinated animals per man per hour.

## SLAUGHTERHOUSE

### 1. Phased-in at pork plants

Slaughter of immunocastrated animals could be phased-in by federal inspection initially accepting immunocastrated animals only on specific days of the week and times of the day.

### 2. New tasks for slaughterhouse

New functions could be provided within the slaughter line. An employee could be responsible for measuring and the separation of animals with testicle's size larger than 110mm and the cooking test for fat of these suspected of having boar taint. Another one could be in charge of removing the testicles and accessory glands of the reproductive tract.

### 3. What about testicles?

As a byproduct immunocastration generates the testicles, which must have a destination. In many places the testicles are used for cooking. Rocky Mountain oysters, mountain oysters, prairie oysters, Montana tender groin or swinging sirloin are North American culinary names given to buffalo, boar or bull testicles. They are usually peeled, coated in flour, pepper and salt, sometimes pounded flat and then deep-fried (Popik, 2008).

### 4. Field against industry?

According to genetics, slaughter weight and destination of animals for carcasses or cuts the gain can vary. It must apply a systemic view of the business to sometimes accept the investment in one area to gain more in another.

## FEDERAL INSPECTION

### 1. Deal with national legislation

The national legislation may not allow the slaughter of boars. The European Community legislation decrees that carcasses from boars that are over 80kg may only be allowed to be used for human consumption provided they are processed, used in small goods, or tested for taint (Council Directive 64/433/EEC of 26 June 1964). There are specific rules for that organization of official controls on products of animal origin intended for human consumption. Meat is to be declared unfit for human consumption if it: indicates patho-physiological changes, anomalies in consistency, insufficient bleeding (except for wild game) or organoleptic anomalies, in particular a pronounced sexual odor (Regulation Number 854/2004 of the European Parliament and of the Council of 29 April 2004).

### 2. Interaction with government veterinarians

They need to receive all technical information related to the technology as well all the related laws. They can help advising and asking for possible adjustment in the slaughter line and / or equipment for analysis of suspected animals. There may be some specific procedures or documentation needs for the qualification of each plant to slaughter boars.

## CUSTOMER

### 1. Appeal for animal welfare

In Europe, increasing interest in farming practices has highlighted the welfare issues surrounding this form of castration and has consequently increased the pressure on legislators to introduce controls (Campbell, 2006). Immunocastration generates a marked reduction in mounting behavior and aggression. Doing a comparison of aggressive behavior frequency and sexual behavior frequency 3 weeks after second dose between immunocastrated, castrated and entire boars, the first two are equal and statistically lower than the last (Cronin et al., 2003). This has resulted in less mortality due to lameness, downer pigs and fighting, and lower slaughterhouse rejections with a reduction in death loss and culls in males of 3-5% (Brennan, 2009).

### 2. Food safety

Pigs that were administered the vaccine orally had no detectable antibody response or interference with normal hormone levels. This provides strong evidence that hypothetical human consumption of vaccine residues would not induce antibodies to GnRF or have any secondary endocrinological effect. Oral administration to rats showed that the vaccine against GnRF is toxicologically innocuous even when it was given at a relative dose of 70 times that recommended by subcutaneous injection for pigs. Injection of the GnRF conjugate showed that this antigen has no intrinsic hormonal activity. The complete lack of hormonal activity of the antigen provides compelling evidence that no direct hormonal effect could occur from the

hypothetical human consumption of antigen in the meat from a vaccinated animal (Clarke, 2008).

### 3. Sensory Evaluation

A survey of Brazilian consumers was designed to understand consumer's attitudes towards vaccination to control boar taint as an alternative to physical castration. Regarding the sensory evaluation were found significant differences ($p < 0.05$) for all sensory attributes evaluated in favor of immunocastrated pigs when compared with physically castrated. The preference test applied to cooked sirloin steak from immunocastrated pigs indicated better preference (66%) compared with physically castrated (34%). The panelists "intent to purchase" was also in favor of the immunocastrated treatment and confirmed the results from the preference and acceptance tests. The majority (74.8%) of the consumers probably (20.2%) or certainly (54.6%) would buy meat from the immunocastrated pigs compared to 58.4% of the consumers who probably (25.2%) or certainly (33.2%) would buy meat from physically castrated pigs (Tonietti, 2008).

## CONCLUSION

Immunocastration is a practice that requires some planning for the implementation and for the consequent results to occur within expectations. We must consider all links in the chain of production to study the adoption, not only in terms of profitability; but also acceptance by today's and tomorrow's customers of pork meat and for the sustainability of pig farming.

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# THE NUTRITION AND ECONOMICS OF FEEDING ENTIRE MALES THROUGH THE GROW-FINISH PERIOD

**Neil S. Ferguson**
**Nutreco Canada Agresearch**
**150 Research Lane, Suite 200, Guelph, OntarioN1G 4T2**
**E-mail: neil.ferguson@nutreco.ca**

## ABSTRACT

With rising feed costs and increasing animal welfare pressure on the practice of castration, there has become more interest in raising entire male pigs for pork production. The benefits of raising entire male pigs as opposed to physically castrated males (barrows) includes better feed conversion efficiency, lower back fat, higher percentage lean and trimmed lean cuts, lower feed costs and potentially higher profit margins. However, before these benefits can be realized the main disadvantage of finishing entire males namely, boar taint, needs to be addressed. There are opportunities to reduce boar taint through genetics, nutrition and immunization against GnRH. The latter technology is available, in some parts of the world, where a two-dose immunization program has been successfully implemented to grow entire males. Over the whole finishing period (25-120kg) immunized males, on average, grow 3% faster, eat 4% less feed, convert feed 8% more efficiently and have close to 10% less back fat than barrows. To maximize these benefits different nutritional and feeding strategies, compared to barrows, are required for rearing immunized males. Nutrient specifications will have to change to meet the higher nutrient demands of rearing entire males, as well as the reduced levels required after the 2nd immunization. Using optimization technology, like Watson 2.0®, to design nutritional strategies that will maximize margin over feed cost, can result in an additional $4-$5 per immunized pig (includes immunization cost) relative to barrows. In general, where a single feed per phase is fed to all animals, it is most beneficial to formulate diets based on nutrient specifications derived from the combined (gilt + entire male/immunized male) economic requirements rather than the specifications for gilts, immunized males or entire males alone.

## INTRODUCTION

Entire male pigs that are produced for human consumption are either slaughtered prior to sexual maturity (85-100kg live weight) or physically castrated soon after birth, to reduce the risk of boar taint and to reduce aggressive and sexual behaviours. Boar taint is primarily a result of the accumulation of skatole, androstenone and indole in fat tissue and is responsible for the unpleasant smell when cooking pork products (Bonneau, 1982; Claus et al., 1994; Zamaratskaia & Squires, 2009). Recently, there has been considerable pressure on the practice of physical castration due to animal welfare reasons (stress, infection), with the likelihood that in many parts of Europe the practice will be banned by 2015 (Pauly et al., 2009). Castration without anesthesia is already banned in Denmark, Norway and Switzerland. With this in mind, as well as the need to improve the efficiency of pork production due to high feed costs, the raising of entire males

for human consumption is back in the spotlight. The advantages of finishing entire males are many, including: better feed conversion efficiency (Dunshea et al., 2001; Quiniou et al., 2010), higher rate of lean gain and lower fat deposition providing more saleable lean tissue (Suster et al., 2006), lower pre-wean infections and mortalities (Kruijf and Welling, 1988) and therefore potentially better economic returns (Deen et al., 2008). Therefore, if the disadvantages associated with boar taint, increased aggression and lower dressing percentage in finishing entire males can be addressed then producers could take advantage of the better feed efficiency and carcass characteristics of entire males compared with physical castrated male pigs.

## PERFORMANCE AND CARCASS CHARACTERISTICS OF ENTIRE MALES

There are numerous studies to show that in group-housed conditions, entire male pigs have similar growth rates, eat less (5-10%), more efficient (10-15%), lower dressing % (4%) due to heavier reproductive organs and surrounding tissues, lower backfat (3-9mm) and higher lean yield (3-5%) than barrows (Campbell and Taverner, 1988; Lundström et al., 2009). The reason for these differences can be partially explained by the higher rates of protein and lower rates of fat tissue deposition in entire male pigs (Whittemore et al., 1988; Quiniou et al., 1996; Suster et al., 2006). Figure 1 illustrates the typical differences between entire male and barrow tissue growth rates.

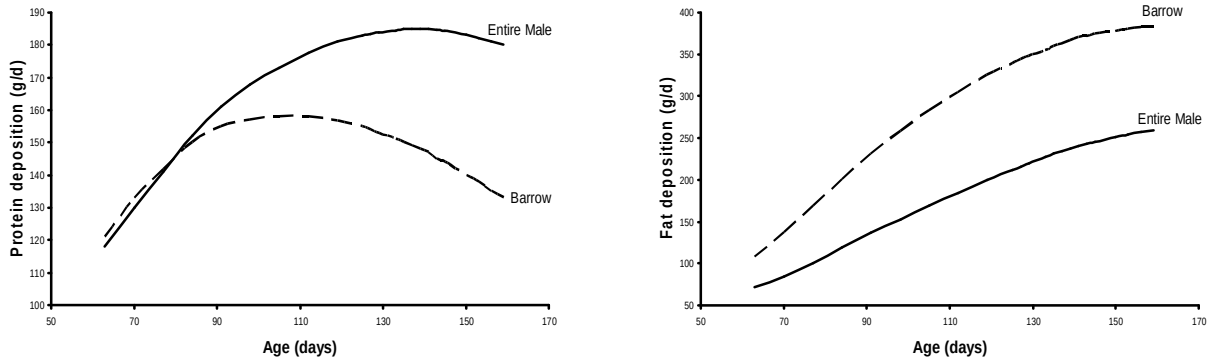


**Figure 1. An example of typical differences in protein and fat deposition rates between entire males and barrows.**

Generally there are few differences in the meat quality of entire males relative to barrows. Entire males have a larger loin eye area and a higher lean cut yield (trimmed ham+loin+shoulder) but they also have a higher degree of unsaturated fatty acids leading to softer fat (Lundström et al., 2009; Pauly et al., 2009; Boler et al., 2010).

## NUTRIENT REQUIREMENTS

When defining nutrient requirements it is important to distinguish between biological and economical requirements because of the practical implications on performance and feed costs. Biological requirements can be loosely defined as the levels of nutrients (e.g. amino acids) required to achieve potential growth or in practice, maximize lean gain and/or minimize

feed:gain. Economical requirements, on the other hand, are those nutrient levels that provide the optimum economic returns, expressed either as maximum margin over feed costs (MOFC) or minimum cost/kg gain. In certain circumstances the biological and economical requirements maybe the same but in most cases the economic requirements for amino acids are lower than the biological requirement levels. There are very few recent published data defining the differences in amino acids (lysine) requirements between entire males and barrows but it is expected that entire males with higher rates of protein deposition and lower feed intakes than barrows, will require higher amino acid:energy specifications in their diets. Using what data were available in the literature and Watson 2.0® (Ferguson, 2006), it would appear that entire males require between 5-12% (25-50kg), 15-23% (55-95kg) and 23-30% (95-120kg) higher levels of lysine than barrows. one mineral deposition, and therefore Ca and P requirements, will follow similar proportional increases as for amino acids (Hendriks and Moughan, 1993).

## ECONOMICS

Valid economic comparisons between entire males and barrows at current market weights (120kg) are inappropriate because of the rejection of entire male pigs at slaughter facilities and the subsequent devaluing of their carcasses. It is expected that over the whole grower-finishing period (25-120kg) and using current (January 2011) ingredient prices, entire males will have feed costs that are $6-$7/pig or $0.07/kg lower than barrows.

## CONTROLLING BOAR TAINT

Zamaratskaia and Squires (2009) review proposed methods to control boar taint through genetic, nutritional and biochemical manipulation. Boar taint is affected by genetic factors, including breed differences, and therefore it is possible to select against skatole and/or androstenone. With the improvement in our understanding of genetic markers and identification of candidate genes, attempts have been made and are currently being made to identify and select against boar taint genes (Varona et al., 2005). To date progress has been slow therefore the opportunity to use genetics to control boar taint is, at best, a long-term solution. There has been some success with using nutrition to control skatole absorption rate and levels from the intestinal tract. Using different dietary carbohydrate (fermentable) sources (e.g. sugar beet pulp, chicory inulin and raw potato starch) it has been possible to reduce skatole levels primarily by reducing the levels of available tryptophan from the turnover of gut-mucosa cells and influencing the metabolism of large intestine bacteria (Claus et al., 1994; Zamaratskaia and Squires, 2009). These dietary interventions are likely to be costly and will have no effect on the other steroid responsible for boar taint, androstenone, because it is synthesized in the testis. The most promising technology to control boar taint is the immunization against gonadotrophin releasing hormone (GnRH) or immunological castration. Once immunized the entire male exhibits similar characteristics as a castrate, including a lack of boar taint and aggressive behaviour (Dunshea et al., 2001; Metz et al., 2002; Pauly et al., 2009). Currently there is no vaccine available in North America but Pfizer are awaiting approval of their product (Improvest®), which has been used in Australia and Brazil for many years (>5 years). As this technology is currently available in most parts of the world and offers the most potential, it is worth further discussion.

## IMMUNIZATION AGAINST GnRH

### Performance and Carcass Characteristics

Active immunization against GnRH will inhibit the pituitary gland from secreting luteinizing hormone (LH) ,which in turn will reduce the production of testicular steroid hormones, including those responsible for boar taint, androstenone and skatole (Claus et al., 2007; Bauer et al., 2008). As the immunization process requires two doses with the latter given 4-6 weeks prior to slaughter, immunized males will grow as entire males for most of the grower-finisher period and only exhibit the reduced (relative to entire males) feed conversion efficiency after the 2nd dose. During the 4-6 week period prior to slaughter, immunized males eat more, grow faster and are more efficient than barrows. Similarly, over the whole fattening period (25-120kg), immunized males will exhibit higher growth rates, lower feed intakes and feed conversion efficiency, and lower back fat than barrows (Table 1).

**Table 1. Average performance of immunized males relative to barrows**

| Source | ADG | ADFI | FG | Back fat |
|---|---|---|---|---|
| Post 2nd immunization period (4-6 Weeks prior to Slaughter) | | | | |
| **Literature average*** | **1.12(±0.11)** | **1.04(±0.05)** | **0.94(±0.08)** | |
| **Nutreco Canada Agresearch (2009)** | **1.25** | **1.07** | **0.86** | |
| **Watson (Avg 3 genotypes)** | **1.10** | **1.01** | **0.92** | |
| Average % difference | +11-15% | +4% | - 7-9% | |
| Whole Grow-Finish period (25-120kg) | | | | |
| **Literature average*** | **0.99(±0.05)** | **0.99(±0.04)** | **0.95(±0.02)** | **0.90(±0.08)** |
| **Pfizer study summary (Pfizer 2010)** | **1.06** | **-** | **0.91** | **0.87** |
| **Nutreco Canada Agresearch (2009)** | **1.05** | **0.95** | **0.91** | **0.91** |
| **Watson (Avg 3 genotypes)** | **1.03** | **0.94** | **0.92** | **0.91** |
| Average % difference | +3% | -4% | -8% | -10% |

*Literature average from 6 recent published studies (2002-2009)

Immunization has minimal effect on pork quality but will reduce the hot carcass dressing percentage by 1-3% points relative to barrows. However, % lean yield will increase by 1-2% due to lower fat and higher muscle depth (D'Souza and Mullins, 2003; Oliver et al., 2003; Pauly et al., 2009; Nutreco Canada Agresearch, 2009; Boler et al., 2010).

## Nutrient Requirements and Optimum Nutrition Strategies

There is minimal published data on the nutrient requirements of immunized males. Generally, the energy content will remain the same although there may be some merit in decreasing energy content of the diet given post 2nd immunization dose because of the increased feed intake and predisposition to deposit large amounts of fat. An alternative to regulating energy intake may be to restrict feed intakes of the immunized males in the last 4-6 weeks before slaughter. Amino acid requirements for minimum feed:gain of the immunized male (95-120kg) will vary depending on the accessibility to feed, but appears to be between -2% and 0% of barrow requirements over the same weight period (Watson 2.0 simulations and Tokach et al., 2010). Although there is no published evidence to suggest otherwise, mineral and vitamin levels will follow similar responses as amino acids.

The most appropriate nutritional strategy to optimize profitability for a particular producer will depend on their production system (genetics, environment, health status, etc.). One of the questions facing a producer, who can only feed a single feed at the various stages of the grow-finish period, is what levels of amino acids should I be feeding to maximize my margin over feed costs when using immunized males. Should I be feeding amino acid levels that will meet the entire male requirements, but then over supply my gilts, or should I feed to satisfy gilt requirements and underfeed my entire males during the grower phase but over feed after the 2nd immunization. Using Watson 2.0® it would appear that the optimum amino acid levels to feed both gilts and males (using 7 Jan 2011 ingredient and hog prices) to maximize MOFC can be ranked according to the following gender specifications: 1) Combined ; 2) Gilt; 3) Immunized male; 4) Entire male; and 5) Barrow. This order could change depending on ingredient and hog prices.

## Economics of Immunized Males

Immunized males will have a lower carcass weight than barrows for a given slaughter weight (e.g. 99% at 120kg), which is exacerbated if slaughtering at a fixed age (e.g. 97.5% at an average of 16 weeks). However, the 2.5% improvement in lean yield and reduced feed costs can potentially increase MOFC by $4-$5/immunized pig (including immunization costs) or reduce feed costs/kg gain by $0.08-$0.09/kg of gain (Watson 2.0, assuming 7 Jan 2011 ingredient and hog prices, on Signature 2010 grid). This is similar to the outcome predicted by Deen et al. (2008) of an additional $5.48 per immunized male versus a barrow.

# CONCLUSIONS

There are significant performance and economic advantages of finishing entire males but in order for this to occur, it requires control of boar taint, packer acceptance and alternative nutritional strategies. Immunization against boar taint offers the most promising option of controlling boar taint as it allows the producer to maximize the benefits of rearing entire males as well as improve profitability. To maximize the financial returns alternative nutrition strategies will need to be defined and implemented.

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# DEALING WITH POST-WEANING DISEASES
# CSI – SWINE: "CRIME SCENE" INVESTIGATION

**Alex Ramirez**
**Department of Veterinary Diagnostic and Production Animal Medicine**
**Iowa State University**
**2231 Lloyd Vet Med Center, Ames, Iowa, 50011**
**E-mail: ramireza@iastate.edu**

## ABSTRACT

The investigation of disease outbreaks in any herd are a complex process. It requires teamwork between the veterinarian and the producer. Taking a good history, utilizing veterinary profiling, and determining the right tests to do, are critical in helping solve disease problems. It is not the result which determines the outcome; it is the correct interpretation of the result which can impact the correct intervention and thus the outcome.

## INTRODUCTION

The objective of a veterinary investigation is to solve a problem. Pigs cannot speak to us directly so the veterinarian and pig producer work together to identify the problems so they can be stopped as well as prevented from occurring in the future. The ultimate goal is to help pigs, producers, and the industry.

## HISTORY

The first thing to do when there is a problem is gather information that will be helpful to clarify the problem as well as provide guidance on possible causes. The process starts by asking the individuals working on-site to find out what all happened. At times, these workers feel like they are being interrogated, but the reality is that the veterinarian is just trying to form an accurate picture and timeline of what is going on. It is through team effort that the investigation can gain strength. Quantification of the problem is critical as it not only provides a feeling for the severity of the problem but also provides a snapshot for comparison so that improvements can be measured. This process of data collection is helpful as most things are not 100% black and white.

## ODDS RATIOS

Odds ratios (OR) are a statistical/epidemiological tool that can be utilized to show associations between two binary variables. By simply collecting data into a 2 X 2 table (yes and no for two separate variables) the strength of the association between two variables can be seen. Odds ratios can be used to help decipher some of the gray areas in data interpretation.

**Table 1. General data layout for a 2 X 2 table.**

| | | variable 1 | |
|---|---|---|---|
| | | **yes** | **no** |
| **variable 2** | **yes** | a | b |
| | **no** | c | d |

Using the above Table, the OR can be calculated by simply cross multiplying and dividing. Therefore:

$$OR = \frac{(a * d)}{(b * c)}$$

The nice thing about OR is that one does not have to worry about which variable is on top and which one on the side; either way, the calculation will result in the exact same value. The value of OR will vary between zero and infinity. An OR = 1 would indicate that there is no association between two variables. A value < 1 would indicate a protective association, meaning that an event is less likely to occur in that group. The association is said to be stronger or more likely to be related the higher the value (> 1) for the OR.

A 95% confidence interval for OR can be calculated but that takes more work. The key thing to remember is to not rely heavily on the result unless a confidence interval is calculated. It is also important to remember that an association does not mean causation.

## VETERINARY PROFILING

According to Wikipedia:

> "Offender profiling is a method of identifying the perpetrator of a crime based on an analysis of the nature of the offence and the manner in which it was committed. Various aspects of the criminal's personality makeup are determined from his or her choices before, during, and after the crime. This information is combined with other relevant details and physical evidence, and then compared with the characteristics of known personality types and mental abnormalities to develop a practical working description of the offender."

This criminal investigation technique has many similarities to what is done in veterinary medicine. Veterinarians look for patterns of behavior in the evidence. For example, when dealing with a respiratory outbreak, the necropsy of a pig will provide some guidance based on the type of lesions found. When dealing with bacterial infections, the lesions tend to feel firm and are usually located in the front bottom part of the lungs (cranio-ventral consolidation). On the other hand, viral infections tend to spread though the blood vessels and therefore result in patchy lesions throughout the lung tissue.

Viruses from the same family tend to have similar behavior patterns so information from different species can be utilized especially when new diseases are emerging. There are always a

few outliers just like in street gangs; sometimes individuals from a gang do not always follow their signature trait.

As a general rule from a clinical perspective it is important to break down viruses based on two important characteristics: RNA vs. DNA and enveloped vs. non-enveloped. Genetic material in the DNA format is very stable. There are special proofreading mechanisms that are in place to ensure that as these viruses replicate, minimal changes in their genetic makeup occur. On the other hand, RNA viruses are very unstable genetically and are constantly mutating creating a very challenging situation for vaccine development. Enveloped viruses are usually highly susceptible to environmental inactivation compared to non-enveloped viruses. The categorizations of different swine viruses of concern are summarized below in Table 2.

**Table 2. Viral grouping of some important swine pathogens.**

| | Enveloped | Non-enveloped |
|---|---|---|
| **DNA** | African Swine Fever (ASF)†<br>Pseudorabies (PRV)* | Porcine Circovirus Type 2 (PCV2)<br>Parvovirus |
| **RNA** | Porcine Reproductive and Respiratory Syndrome (PRRS)<br>Transmissible Gastroenteritis (TGE)<br>Classical Swine Fever (CSF)†<br>Japanese Encephalitis†<br>Influenza (IAV)<br>Vesicular Stomatitis (VS) | Foot and Mouth (FMD)†<br>Rotavirus<br>Swine Vesicular Disease (SVD)† |

† Foreign animal disease.

* PRV has been eradicated from Canadian and U.S. domestic swine population.

## AGENT OR ANTIBODIES

When veterinarians are looking to identify the culprit of the disease outbreak, they are focused on determining the time frame of events. This will allow them to decide whether they need to focus on finding the organism/agent (or parts thereof) or try and find antibodies. The agent is usually found earlier in infections whereas antibodies take time to develop (usually 10 -14 days).

The interpretation of antibodies is not always easy. As can be shown (Figure 1), an antibody titer of X can actually represent three different time frames in the exposure life of an animal. Time $X_1$ would be at the start of the first time the animal has been exposed to the agent and antibody production is on its way up (log phase). On the other hand, time $X_2$ represents the decline phase of antibodies. The difference between time period $X_1$ and $X_2$ is clinically relevant. Finally time period $X_3$ represents the log phase of a second exposure.

## TIME

Time is also a critical part of the puzzle. As mentioned above, time will dictate if you might be able to find the agent or antibodies. But time also plays a critical role in helping determine what

is going on. More time does allow for an increased chance for finding out what is going on in disease outbreak situations. Usually with more time, more animals will be infected (Figure 2). This can explain why one veterinarian may not find the agent causing problems in the early stages of an outbreak and another veterinarian can appear to be the heroine when she is called for second advice three weeks later. It is also important to realize that sometimes time can make things more complicated as secondary agents can compound issues.

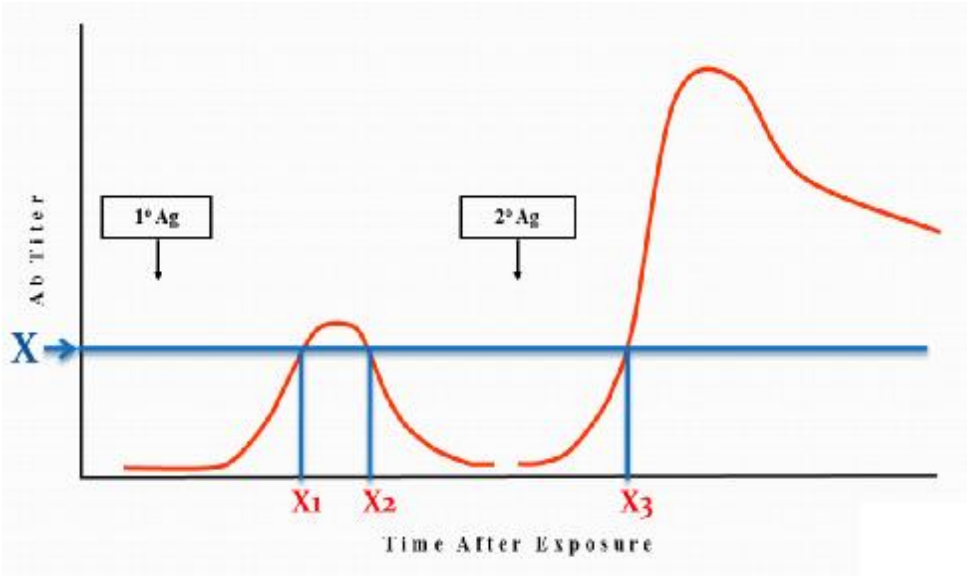


**Figure 1.** **Possible explanations/interpretations for obtaining an antibody titer value of X without knowing the animals actual time of exposure.**

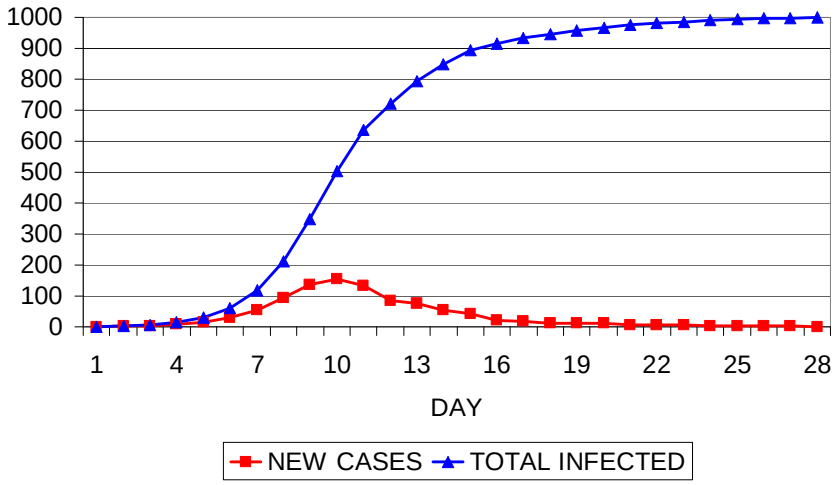


**Figure 2.** **Prevalence of new infected cases as well as cumulative cases in a disease outbreak affecting a 1000 head barn of pigs.**

## TESTING

Deciding what to test for as well as how many to test is a challenging decision. It takes knowledge, experience and a full understanding of the pros and cons of each test along with their

respective costs. All this information is needed to make the right decision. There is no simple answer to all cases. Veterinarians must consider all the evidence at hand as well as the clinical picture in making their decision. Ultimately only tests are performed which will have an impact on the outcome. That is, a test should never be done unless one knows what will be done with the results. How many samples to test for is really a matter of insurance. How much is the producer willing to pay in return for how much risk? Statistics are used to help provide us the necessary data to support those decisions.

Some of the best tests are those that allow one to identify the agent at the site of the lesion, with pathology that supports the clinical signs noted. A good example for this is trying to show the effects of TGE in the intestines of pigs. Most of the time just finding the TGE virus in a group of pigs is diagnostic for having a problem. Being able to show the agent present at the tips of the intestinal villi (brown coloring) that have been shortened is strong evidence for the virus not only being present, but also causing problems.

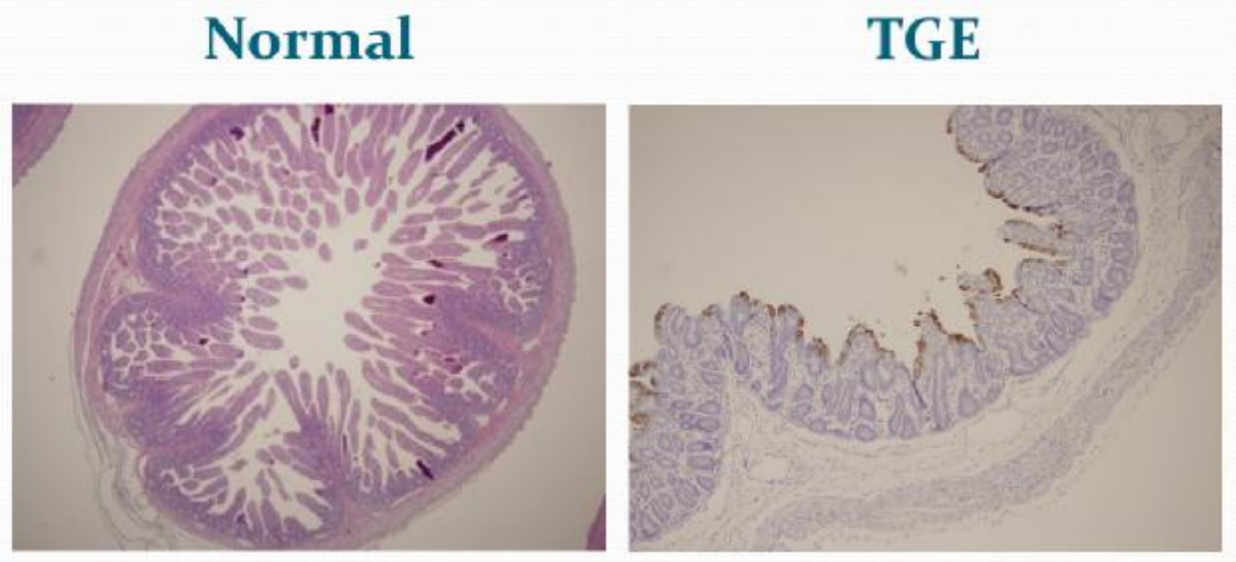


**Figure 3. Two histologic sections of intestines showing normal and TGE affected intestines. The TGE affected intestines have been stained with immunohistochemical compound which attaches to TGE viral particles and is brown in color.**

## CONCLUSIONS

The diagnosis of diseases is not an easy task. Veterinarians and producers need to work together to make sure the right information is collected and that the results are interpreted correctly. This takes knowledge that is constantly being updated, field experience, understanding practical implications of the different diseases, and patience as our diseases today seem to be multi-factorial and complex. As a team, the ultimate goal is to help pigs, producers, and the industry move forward in maximizing pigs' health, welfare as well as protecting the public's health.

# DEALING WITH POST-WEANING DISEASES - POST WEANING DISEASE CHALLENGES AND MANAGEMENT SOLUTIONS TO IMPROVE PRODUCTION EFFICIENCY

**Steven Wolfgram**
**South West Ontario Veterinary Services**
**225 Oak Street, Stratford, Ontario, N5A 8A1**
**E-mail: swolfgram@southwestvets.ca**

## ABSTRACT

Disease challenges in the nursery can impact profitability through increased input costs (feed, medication and vaccines, veterinary services, labour) and decreased productivity (increased mortality and culls, decreased feed efficiency). In order to design and implement an effective plan of action, we need to understand what disease challenges we are facing, and to what degree those diseases impact production in the nursery and in other phases of production.

## BACKGROUND

The newly weaned pig is unique in that it faces a multitude of changes in a short period of time that may predispose it to disease challenges. The weaning event and transition to a solid-food diet, mixing with pigs from other litters (or from other sow herds), changes in environment, handling/vaccination and transportation are stressors that can put the weaned pig in an immunological disadvantage, regardless of what pathogens may be present. During the nursery phase, the pig also undergoes an immunologic transition, with maternally derived colostral immunity diminishing over time, and the pig's own immune system maturing.

When dealing with disease challenges in the nursery, we need to have an understanding of the disease dynamics before we can put together an action plan. By reviewing production records and performing appropriate diagnostics, we should be able to answer the following questions:

- What pathogens are responsible for the disease challenge? In some cases more than one pathogen may be present, either as co-infections, or as a primary pathogen with a secondary opportunistic infection. If a bacterial pathogen is present, what is the antimicrobial sensitivity pattern?
- When do clinical signs appear? Is there a pattern to the appearance of the disease, or is it more sporadic?
- How severe is the disease? This can include the severity of clinical signs, the number or percentage of animals affected, death loss and the degree of response to initial interventions.

- What is the health status of the sow herd(s)? Whether or not the pathogen(s) are present in the sow herd will have an impact on what strategies are used in the nursery.
- What is the impact of the disease challenge in the grow-finish phase?

## DISEASE INTERVENTIONS

Specific intervention strategies should be customized for the disease and herd in question, in consultation with the herd veterinarian. In order to evaluate the success of the interventions put in place, data such as treatments and death losses should be recorded. For the purposes of this paper I will outline the principles behind various nursery interventions that are available.

### Antimicrobial Therapy

Antimicrobials can be administered through the feed, water, or by injection. Antimicrobial selection should be based on the sensitivity patterns from recent diagnostics. During a disease outbreak, antimicrobials may be administered to the entire population of pigs. Antimicrobials given on a preventative basis should be targeted to pigs that are most likely to be at risk of being affected by the disease.

### Vaccination

Nursery pigs can be actively immunized at weaning, as is the case with an oral E. coli vaccine, or with vaccination for Porcine Circovirus type 2. One of the challenges in dealing with vaccinating nursery pigs is being able to administer the vaccine early enough, before clinical signs are seen, in order for the vaccine to be effective. An alternative approach for diseases such as Swine influenza, ***Strep. suis*** and ***Haemophilus parasuis*** (Glasser's) is to vaccinate the sows prior to farrowing. In this case, the colostral immunity is boosted, providing a higher level of passive immunity to the pigs during the nursery phase.

### Good Production Practices

It is easy to overlook everyday tasks when dealing with a disease outbreak, as there may be more time spent examining and treating sick pigs. Washing and disinfecting rooms will reduce the pathogen load for the next group of pigs to enter. Checking feeders and water nipples or bowls ensures that the pigs have access to feed and clean water. Ensure that room temperatures and ventilation rates are appropriate, as poor air quality can predispose pigs to respiratory disease. Check to make sure young pigs are starting on feed, and if not, stimulate eating by offering gruel feed or floor feeding. Confirm that feed is formulated appropriately for the age of pig. Both internal and external biosecurity measures should be reviewed to prevent disease transmission within the barn and to prevent entry of any new diseases into the nursery.

### Depopulation / Repopulation

This is an effective method of eliminating a pathogen from the nursery site in situations where the sow herd is not the source of the pathogen. All-in/all-out barns effectively do this between each batch of pigs. For continuous flow nurseries to undergo depopulation, alternative housing is needed for the weaned pigs, or the weaned pigs may be sold during the period of depopulation.

### Temporary Herd Closure

A temporary halt to the introduction of new animals in the nursery can be used to eliminate a pathogen such as Swine Influenza, where the virus is only shed for a short period of time. The herd closure must be of sufficient length to allow all the resident animals to become infected and finish shedding the virus. As with the depopulation / repopulation, this will only be effective in cases where the sow herd is not the source of the pathogen.

## CONCLUSIONS

The response to a disease challenge will vary from situation to situation, depending on the pathogen(s) present, severity of clinical presentation, and the cost and effectiveness of control measures available.

# SELLING PIGS TO MARKET PORK

**Martin and Teresa Van Raay**
**Dashwood, Ontario N0M 1N0**
**Teresa@thewholepig.ca or Martin@thewholepig.ca**
**Website: www.thewholepig.ca**

## ABSTRACT:

Delivering Pork from our farm to your freezer. We deliver within 100 miles and will go further if asked. No one else is paid to promote our product other than through margins (featured products at grocery). The pork industry has presented many challenges over our career as producers. The past 4 years in particular, were financially challenging and this model gives us the opportunity to stabilize some of our income. Our ever-changing pork consumer, media influence, inaccurate portraits of agriculture, and a general misunderstanding about pork have also inspired us to do this. An important feature of The Whole Pig, is the "Whole" aspect; achieving life-balance in health and nutrition. We show our customers how pork fits….and because it is so versatile and tastes awesome, it fits into everyone's lifestyle. Now…..getting the word out!!!

## WHO WE ARE:

The homepage on our website describes who we are this way:

> "From our farm to your freezer; this is the Whole Pig experience. We specialize in delivering a variety of high quality pork products directly to your home and supplying you with the tools and recipes to maximize your dining experience.
>
> Our pork is home grown at our farm near Dashwood, in Southwestern Ontario. We use the highest quality standards when raising our pork, which is obvious in the end product. Our pigs are fed corn, soybean meal, whey and a supplement which is fortified with essential vitamins, minerals and amino acids to optimize our pigs' health and nutrition.
>
> The product is then processed at our local abattoir; Metzger Meats-where the talented Gerhard Metzger and his team trim and prepare the pork to our specifications. Our pork is always vacuum packed and frozen within 20 hours of processing, or as we like to call it 'freshly frozen'. When our product is defrosted at home, it will be equivalent to fresh pork and have very little moisture loss. Our packages come in a variety of sizes, with the smallest fitting into most fridge freezers. A quarter order gives 2 people, 2 meals a week for 6 months with at least 15 different meal options. The IHNIWTOO (I Have No Idea What to Order Order) includes roasts, ribs, steaks, sausage, bacon, burgers, pork tenderloins, 'porkerettes', and hocks -- you get them all (Porkerettes are awesome 100% Pork Meat Sticks).

Through our website, you have access to a Nutritionist, Strength Coach and Chef and of course us, Martin and Teresa Van Raay, to answer your questions on how pork fits into your lifestyle (fast, slow, single, family, sports enthusiast, baby boomer, generation X, Y or Z).

Remember, it is important to eat a balanced diet daily; pork is an important part of this. Not only does pork supply you with essential vitamins and minerals it is a lean source of protein and just plain delicious. Pork has been misunderstood for a number of years when it comes to fat content. Did you know pork has 10 cuts that are lower than 6 grams of fat per 100 g serving?

With The Whole Pig you will know how your food is raised, know it is butcher shop quality, and that the ground pork, burgers and sausage are gluten and MSG free (Ingredients: pork meat and spices)

Whether you choose the 1/4, 1/2 or the whole pig, you can tailor a package to suit your lifestyle.

We deliver and we stand behind our product. A package of our products in your freezer is like having your own personal meat counter available to you anytime."

**WHY DO WE DO IT?**

Challenging, tough, difficult, frustrating, emotionally draining, equity decreasing, are some of the words to describe what we have experienced the past 4 years as pig farmers. We made many changes over these years to get us to where we are today. One of the biggest is that we changed our operation from a farrow to finish to a wean to finish. We are very fortunate to have become associated with a single weaner supplier who has the same passion for pork that we do. That is the pig side.

For the pork side of our life we have taken our pork to our local abattoir and served it to our growing family for over 28 years. We know our product is very healthy because it has been, and still is, our family's main source of protein, at least 7 times a week. We can back this up with industry research. As our family grew we served our pork at many meals and parties to raving reviews of the quality and taste. It was becoming apparent that what we ate as pork and what others did, was not the same. Added to this we saw consumers who wanted to know where their quality food products came from. There were misconceptions of the health benefits of pork, and a disconnect between farmers and consumers. In response to all this The Whole Pig was born, October, 2009 (www.thewholepig.ca).

**HOW DID WE DO IT?**

We aren't there yet and we've had a lot of help so far!!!

At first we met with a couple of business coaches to help us set out our business plan. We developed the website working with two different companies plus both of us spending a lot of effort to figure out what information we wanted to include. When we decided we wanted to

offer expertise to balance the plan we established relationships with a nutritionist, strength coach and a chef. We made sure we had permission to use all the pictures and information from others (i.e. Ontario Pork and Foodland Ontario). We also started the process to trade mark our logo and legally get the Whole Pig Company registered. Now we have the ground work set….how do we sell our product?

## EDUCATION FOR OURSELVES

To sell more pork what do we need to learn? Do you know the saying, "the more I learn the less I know"? It describes us very well. Whether it was "how to design a website", "how to calculate grams of protein people need in their diets", "understanding social media—Facebook, twitter, e-mail", or where to source supplies (containers, freezers, labels…), it was quite the learning curve. We have some great people and companies working with us. They want to help us be successful and it shows with the quality of service they provide.

## INFORMING OUR CUSTOMERS

Why and how to eat pork. There are many misconceptions out there and because our advertising budget is not the same as OPRAH (heard of Meatless Mondays?) we need to be inventive.

The following is a very real example of misinformation or misunderstanding about pork. We were just starting to get out there in the public eye and had the opportunity to attend a nutrition forum, as both sponsors and participants. One of the keynote speakers who has his PhD and is a CSCS (Certified Strength and Conditioning Specialist) was selling a "cookbook" as part of the whole nutrition and strength package. It was well done, very comprehensive, and did not include one recipe for pork. When we questioned why this was we were told because "pork is fat". I knew we had to now change the world one recipe book at a time. Where are these University educated "teachers" getting their information? Why are the obesity and diabetes rates going up? Proper nutrition and exercise is the "Final Diet" you need to live a long and healthy life (www.graemethomasonline.com).

Fresh is Frozen. Educating our customer on the process and what that means to our product quality. Again, we are dealing with misconceptions that frozen products are somehow of lesser quality than fresh. When you get the chance to explain they are receiving product that has been freshly frozen within 24 hours of processing – that is fresh. And make sure they don't use the microwave to defrost.

## PROMOTION

This is a constant part of the business. Connecting with our customer is very personal. This is a new and unique concept to our customers. These are people who want to re-connect with the farmer, so we find personal contact is key. We have attended over 20 different shows and events to give the opportunity for potential customers to talk to us, and see and taste the product. We

have also donated a lot of product to social events (fundraisers, prizes), become a street vendor in Grand Bend and helped sponsored a body builder…to name a few. Once we started getting our name out there we found there were no shortages of opportunities to "give product away" for promotions. This has been both good and bad. How do you know which events to participate in and which ones not to?

With print and radio promotions too, this is interesting and ever-changing. We even have a jingle and if you ask Teresa will sing it for you. We've tried to get our ads into magazines and newspapers which reach our target audience. We have printed business cards, brochures, and other paper information. We always have business cards and brochures with us. You never know when you will meet your next potential customer. Promotion is a big budget item. We have established relationships with a number of companies who have experience in website and promotion material design to help us. and we researched other companies to find out what worked for them…and what didn't.

**WHAT WORKS**?

Networking and getting out there. As pig farmers who have sold our pigs to a processing plant for 28 years, we had given little thought to marketing pork. The Whole Pig experience has opened doors we didn't know were out there. We learned so much about our own Huron County which is very rich in foodie events and publications. For example in Huron County we have the Taste of Huron, numerous farmer's markets, fairs, Rural Business Network, POWE, Regional Food Summits, Huron Perth Farm to Table, Chambers of Commerce, home shows...and the list goes on. When we look beyond Huron County to London, Sarnia, Guelph the events are infinite. We are looking forward to our first cooking/speaking demonstration at Women's Lifestyle show with Chef Devin (www.bonvivantchef.ca).

Some of our challenges have included teaching our customers how to cook certain cuts and about pork terminology. Are we speaking the same language? Early on we discovered that a ham to us is not the same to our customers. Ham to our customers is smoked or black forest ham. It is not a pork roast from the ham of the pig.

Packaging is very important for both quality and product appeal. We are selling a high quality product. The customer needs to see this.

Ontario Pork with Pork Marketing Canada has produced some very good printed recipes and information on the nutritional value of pork (Powerhouse of Pork) along with understanding where different cuts come from. When we deliver packages we explain the paperwork we leave behind. Not everything, because that would take too long, just enough to show them some easy defrosting and cooking tips. We also connect them with the OFAC website with the virtual farm tours. This is a big hit with young families. We also provide personal recipes and invite any comments or questions anytime. We especially appreciate the recipes and tips our customers give to us.

## WHAT ARE WE SELLING

- High quality, nutritious, great tasting pork
- Ourselves
- Protein-why?
    - Builds & repairs body tissues
    - Regulates body processes
    - Forms antibodies to fight off infection (Powerhouse of Pork)
- Premium Packages to fit different lifestyles
- Fundraising Packages
- Delivery
- Nutritional Information
- Recipes
- High quality, nutritious, great tasting pork (not a typo…we need to keep telling people)

## LET'S LEARN

The following two blocks are tidbits from our nutritionist and strength coach. We believe the information they share through their websites and courses deserve a mention. Both of these individuals have helped us to continue learning and to challenge old and new information.

| **Balance: Nutrition & Exercise**<br>www.jvrtraining.ca |
|---|
| **You can't out-exercise what you eat.**<br>i.e. no amount of exercise will undo poor eating habits<br>**You can't eat your way fit.**<br>i.e. no amount of fruits and vegetables will keep your bones, muscles and heart strong<br>**You can't get to your goals without a plan.**<br>i.e. if you don't know how you're going to get there, how do you know where you're going? |

| **Balance: 10 Habits of Healthy Eaters**<br>www.graemethomasonline.com |
|---|
| 1. Eat every 2-3 hours<br>2. Eat complete protein at every feeding<br>3. Eat veggies at every feeding<br>4. Earn your starchy carbohydrates<br>5. Balance your fat intake<br>6. Avoid calorie containing drinks<br>7. Focus on whole foods<br>8. Eat "clean" 90% of the time<br>9. Develop sound food preparation strategies<br>10. Enjoy a variety of foods |

## CHALLENGES

- Product development – our packages continue to change to incorporate the needs of our customers.
- Focus – do not try to do everything and thus accomplish little
- Listen to advice and use only what applies to you
- Continue to learn – making sure we are up on the latest information, regulations, food safety, nutrition, exercise, events, media opportunities, etc.
- Frozen versus fresh
- Keep in contact with customers. i.e. 20 pigs per week, sold by quarters, means 80 customers to contact and deliver to.
- Shutting it off. – we get a little passionate about our products and need to keep our own lives in balance.
- Pricing our product

## CONCLUSIONS

The Whole Pig is a wonderful opportunity for us to connect directly with our customer. The relationships we have developed with customers, new business associates and our new service providers, is an added bonus to stepping outside our comfort zone. Our future includes increasing sales to the point of getting a delivery truck on the road. We are considering supplying fundraisers, having stores carry the products, or new packages by customers request as ways of selling more pork;

We have seen, many younger Ontarians wanting to cook and entertain. They want to serve their family and friends great food. The highlights include: dropping off pork to a customer who is getting ready to prepare a gourmet meal for a dinner party; having the 12 year old boy from the city ask his Mom if this is Teresa's pork; a 9 year old who asks for seconds of Pork Chili after tasting it for the first time; and a couple, married 40 years, gushing about the crown roast they served for New Year's. We know we are on the right path. We are very keen to help put more "Pork on Ontarians' Forks".

## SOURCES AND RESOURCES

**www.putporkonyourfork.com**

**www.graemethomasonline.ca**

**www.jvrtraining.ca**

**www.bonvivantchef.ca**

**www.ebpros.com**

**www.goldenpathways.ca**

**www.sophisticatedwino.com**

# CHANGING THEIR MODEL: THE IOWA FOOD COOPERATIVE

**Gary Huber**
**Iowa Food Cooperative**
**2402 South Duff Avenue, Ames, IA 50010**
**E-mail: gary@iowafood.org**

## ABSTRACT

The Iowa Food Cooperative is a direct-to-consumer distribution system that uses a website and the internet to facilitate sales from producers to consumers in the Des Moines area of Iowa. It is one of nearly two dozen such cooperatives that currently exist in three countries. Its basic features are described.

## INTRODUCTION

I serve as general manager for the Iowa Food Cooperative. I don't raise and market hogs. As the IFC's manager, I work with several hog farmers to help them market their hogs using a unique direct-to-consumer distribution system. My presentation will describe the basic features of this system, which we feel can be adapted to other locations.

## DESCRIPTION OF THE IOWA FOOD COOPERATIVE

The IFC was incorporated in the State of Iowa as a cooperative in July 2008. It is what is known in the United States as a "new generation" cooperative, meaning both producers and consumers can be members. It is governed by an eight person board of directors, half of which are farmers and half of which are consumers.

The IFC launched operations in November 2008. Its trade area is the Des Moines metropolitan area, which is home to about 670,000 people. It is a .0direct-to-consumer distribution system that uses a website and the internet to facilitate commerce between consumer and producer members.

The system uses software first developed by the Oklahoma Food Cooperative. Producer members upload information on their farms and products to our website (www.iowafood.org), and consumer members choose from among the products by placing them into their online shopping cart. The shopping cart is open for orders during a set time each month, after which it closes. Producer members then go online to see who ordered products. If they have sold a variable weight product, such as a pork roast, they weigh these products and input this weight so consumer invoices can be finalized. They then use the software to print out labels for their orders, which are attached to each ordered product.

Producers deliver orders to a site at a retail mall in Des Moines in the morning of distribution day where products are checked in, sorted, and stored until consumers arrive in late afternoon and early evening to pick up and pay for their orders. We also have a second location where products can be picked up, and orders for this site are transported to that location in the early afternoon. We currently operate sixteen distributions each year, one each month except July though October when we conduct two per month. In February 2011, just over 800 different products were listed. In 2010 producers sold a total of $143,569 in products.

We have a fee system to generate operating revenues. If a producer sells $100, they get paid $90. If a consumer buys $100, they pay $110. We currently have 552 members, of which 78 are producers. Products range from eggs to produce to meats to baked goods to non-food items such as soaps and candles. All items offered for sale have to be grown, raised, or made by the producer selling the product.

Certain features of this model are attractive. Its members own the business. Farmers set their own prices. The website and software make transactions easy and help reduce time requirements. Farmers only sell what they have available, and they only deliver what has been ordered. The cooperative has no inventory. It does not need to keep shelves stocked and hire staff for a retail store that is open for business seven days a week. It is a model that has the potential to be adapted in other locations.

## CONCLUSION

There are nearly two dozen cooperatives in existence that are based on this model. Most are in the United States, but two are in Canada and one has just started in Australia. It has various features that are attractive. This model also has the potential to be adapted in other locations.

# WILLOWGROVE HILL DHA/EPA OMEGA-3 PORK MARKETING

**Paul Hill**
**Willowgrove Hill**
**RR # 5, Mitchell ,ON N0K 1N0**
**E:mail: order@willowgrovehill.com**
**www.willowgrovehill.com**

## INTRODUCTION

This presentation will outline some of the ways that Willowgrove Hill DHA/EPA Omega-3 Pork (WGHO3) has brought this amazing product to the market place.

How do you tell a story about yourself, your company, in 30 minutes that has taken you and your wife over three and a half years to develop, without missing anything? I will share with you some of the complexities of marketing your own products. First of all, it is not for everyone.

I will try to tell you how we have marketed WGHO3, our truly unique Docosahexaeenoic acid and Elcosapentaenoic acid or DHA/EPA (fish oil based) Omega-3 pork, which is considered a functional food.

## BACKGROUND

Just over three years ago, Rosie and I decided that we needed to change our pork operation from a commodity based pork to something that would differentiate ourselves and give our customers what they wanted: healthier choices. My brother-in-law, and now partner, had been after us to create a brand and go straight to market for years. The problem was we never had that product to do it with, until now! We developed this product for two reasons. People were starting to demand these types of healthier products and for personal reasons.

## FUNCTIONAL FOODS

So what are functional foods and why did we want to be one? Functional foods are defined as foods, fresh or processed claiming to have health-promoting and/or disease-preventing properties. Currently, WGHO3 is the only pork product on the market that is able to make a health claim. The functional food market is expanding as people are becoming more interested in the relationship between their food and their health.

Omega-3-enriched products are the major component of the functional food market.

Everyone knows that Omega-3 is good for them, but most people are surprised to learn just how good it is for them!

Currently, there are over 14,000 health studies that have been done on Omega-3's, but even with all of these studies, we still need to do a better job of educating the public on the health benefits, because it is and will be the consumers that drive these functional food markets.

Corporations, I feel, should also take a certain amount of responsibility in marketing these products and getting these products to their consumers. After all, they use slogans like: "mainly because of the meat" or "Food at its best". Retailers always say they have the best and want to differentiate themselves from others. My question is then, why is it so hard to get these products on their counter?

Finally, our government should play a major role and get involved to promote healthier eating and functional foods. I fear sooner than later our Health Care System will be stretched to the breaking point and then they may have to answer some harsh questions. Better to be proactive.

**OUR STORY**

I would like to tell you a bit about my history and family. Everyone that I meet tells me, you have a great story. Something I guess that is needed to help market your own product.

I have been hog farming since 1971 – that's 40 years of experience. That was the year my Dad had this great idea and bought our first 18 sows, as a "make-work" project for my brother, sister and I.

In 1973, I lost my father due to a heart attack. I was 11 years old. I continued to work on the family farm until I completed high school. I then left home to attend the University in Guelph, where I spent one year, before deciding that I just really wanted to farm. So, I returned home and continued on with my 18 sows, 200 acres of land and a job off-farm.

In 1988, I met my wife, Rosie. After nine years of dating, making sure she was the right one, Rosie and I got married, happily, and we started to work in the barn together as a family business. In August of 1999, we were blessed with our first son, Ryan. In July of 2001, our son fell ill, and was diagnosed with liver cancer. The first week of September, we brought our son home from the hospital and on September 12, 2001 watched Ryan pass away. He was just two years old. Three months later (Rosie was six months pregnant when we lost Ryan), we were once again blessed. This time a daughter, Maddie. In March of 2003, we welcomed our second son, Joey.

Two years to the date that our son Ryan was diagnosed with cancer our daughter Maddie became sick with the same symptoms as our son had. We again went to the London Sick Kids Hospital as we had with Ryan, and prayed. It took all day. We saw the same doctors, did the same tests and in the end we found out that our daughter, Maddie, had a ruptured appendix. So Maddie had the hour and a half surgery and when the doctor came out, she grabbed me, looked me in the eyes and told me there was nothing else in there; meaning cancer. Maddie had a week's recovery on the 7th floor of sick kids in London (which just happens to be where the children with cancer are). It was during this time that we started noticing families from two years earlier.

We are farmers; we are the first in the food production chain. So, if you are going to make healthier foods should it not start here, as naturally as possible and not after it leaves the farm? We supply the food to people, how can we make a difference, make it healthier?

In our case, by the time the cancer was found it was too late for our son, Ryan; but was there a way of preventing it? I started to think about vaccines and how they prevent certain diseases. Could we prevent certain diseases with food? So that was one of the concepts, making kids healthier with healthier food.

We need the consumers, to be more educated on these types of functional, value added products, so that they would know all the health benefits that are being enriched into these types of foods. You have to come up with a very unique product. Something that will set you apart, something that differentiates you from others.

We thought about natural pork, organic pork and humane pork, which by the way all have no health benefits. Then it hit us – Omega-3 pork. This made perfect sense to us, given our family history, not to mention the fact that consumers were starting to become more and more aware of where their food was coming from, what was in it, and they wanted a healthier choice. We started watching certain products such as bottled water and the Omega-3 eggs, which today have almost 35% market share.

## OBJECTIVES

1) **Give the consumers what they want.** People want healthier choices for their families. People want to know what they are putting into their mouths. People want to know where their food comes from and what is in their food.
2) **Sustainability** was the second objective in the creation of this value-added, functional product. This meant becoming a profitable hog farmer again; something that most people don't realize has been extremely hard to do in the last four years.
3) **Create a superior pork product**, the likes of which the world had never seen. This would give us a huge market advantage over more conventional pork products and would allow us meetings never thought possible.
4) **Make the product scalable–** the most ambitious objective. Planning so that once the Willowgrove Hill products started to command a market share, we would be able to take on ambitious third-party barns, thus enabling more Ontario pork producers to become profitable as well.

## ABOUT OMEGA 3'S

The research began, because in order to be able to talk about a product, you must know something about it. We learned that Omega-3s are very healthy for us. In fact, they are essential to human health and this is why Willowgrove Hill DHA/EPA Omega-3 Pork can be called a functional food. DHA/EPA Omega-3's are responsible in reducing the pain associated with arthritis. They reduce the severity of autism.

The major health benefits include reduced risk of heart attack and reduced risk of certain types of cancer. I am sure that everyone has been touched by cancer in some way. After living through and seeing what cancer is capable of, we thought if we could just make that difference to one family's life, then all of this would be worthwhile.

We also learned that Omega-3's play a key role in child development, the fetus included, particularly in the growth of the brain and other nervous tissues. Has anyone ever tried to get a child to take some medicine? It is almost impossible. But what kid does not like bacon or a ham sandwich?

There are three major types of Omega 3's - DHA, EPA (fish oil base) and ALA. ALA Omega-3s are found most often in plant sources, such as flax, canola, nuts, soybeans. However, our body's, liver, must convert ALA Omega-3 into the health benefiting DHA and EPA Omega-3. This is a very inefficient process. Males process ALA Omega-3 into DHA/EPA Omega-3 at about 2% and females do so at about 4%. We also learned that the only Omega -3's that give any benefit to human health are DHA/EPA and the human body does not produce these types of Omegas – they must come from your diet.

DHA supports the normal physical development of the brain, eyes and nerves. EPA is for the management of cardiovascular diseases and supports heart health. Studies show that by taking EPA Omega-3 regularly you will be 45% less likely to have a heart attack. Your cells become elastic, so blockages are less likely. Every cell membrane in your body contains Omega-3's.

The main source of DHA/EPA Omega-3s is fatty fish, but not everyone likes the taste of fish. Do you remember the cod liver oil our parents use to give us? Why not give people another option - nutritionally enriched pork! As I mentioned earlier, I do not know many people who don't like ham or bacon.

## THE PRODUCT

To get the biggest bang for your buck, DHA/EPA Omega-3 is the way to go. And, that is exactly what we implemented with the help of our nutritional company, Grand Valley Fortifiers, from Cambridge, Ontario. We were able to create the first and only DHA/EPA Omega-3 pork in the world. Willowgrove Hill pork is enriched nutritionally through the feed as naturally as possible using a patent pending process. The Omega-3's are found in the marbling of the meat and since we have more marbling we have high Omega-3 levels.

Our feeding program and protocols took about two years to develop with almost a million dollars being spent and are all highly secretive for obvious reasons. But we didn't stop there. Instead, we took our pork a couple of steps further. We added organic Selenium. A product made by Alltech Canada.

Think of Selenium as the CEO of your Immune system. Selenium is a trace mineral that is linked to strengthening the immune system. Selenium is also known to reduce the risks of breast, colon and prostate cancers as well as heart diseases. In fact here is a pretty cool story: GVF supplies Selenium to third world countries to people who have contracted AIDS with extraordinary results. These people are getting healthier and are starting to get their lives back.

After seeing the positive effects of our feed on our pigs we then decided to remove all antibiotics from our system. So, our pork is "raised without antibiotics" from birth to market, sow herd included. We never give our animals drugs. Willowgrove Hill pork is free of all growth hormones and any animal by products with the exception of the fish oil, which further enhances our value-added product.

Remember the old saying, "You are what you eat"? Actually you are what "they eat". So, we started the process of enriching our pork, but we didn't tell anyone what we were doing. I was once told it is always the second rat that gets the cheese. Instead of doing small trial groups, we tried doing this program on a commercial scale first. This way we could figure out the bugs quicker, (which there were lots of ) allowing us to get this product to market quicker.

## MARKETING THE PRODUCT

So, now that the process is rolling in the barns, we're thinking, "Wow, we have some healthy, safe pork here – a first in North America and perhaps the world. People are going to be beating down our door to get some of this stuff!" Wrong!

Pricing and marketing have been the two most complicated parts of getting WGH to the market place. Where do I begin? There have been so many people that have been so helpful. Many have listened to our idea and liked the fact that we were trying to do something different – that we were thinking outside of the box.

**Lesson number one: Don't think like a farmer**.

That was one of the first pieces of advice someone gave me, and boy, was he right. I don't consider myself to be a stupid person but this was and sometimes still is completely overwhelming.

**Next lesson**: **Marketing your own product is not for everyone.**

If you don't have the passion, the desire, the persistence, the resources or the connections, you might want to stop before you even start. Sometimes I wish someone had told us this before we started, although I likely wouldn't have listened.

**Is this a niche market?**

I was asked a question at a Conference in April of last year: "When does a niche market cease to be a niche market?" I really hadn't given that a lot of thought back then, but I now think we are starting to approach that. I was at a meeting with our federal processor and I mentioned this question to them. One of the senior people at the meeting corrected me and said, "Willowgrove Hill is not a niche product – it is pioneering a functional food industry." That really struck me – actually, it scared the crap out of me. What a huge undertaking we have taken on, by ourselves!

**Seek out Expertise**

First, we surrounded ourselves with great people, realizing that each of those people has a specialty, and we needed to follow **their** advice. I know how to raise pigs, marketing not so much.

Rosie and I started to design our web page. Our partner saw it, and we were promptly told what he thought of it. He knew where we could get a website put together, so we contacted a company in Toronto that had done marketing and communications work for his firm. A few days later, we found ourselves in downtown Toronto, in a boardroom office, in a business meeting (not around the kitchen table, as business meetings are conducted at the farm) to create our website. This was our first taste of how things would be done – properly. So, now we have a great website! Watch out! Sales are going to take-off! Well, not exactly. A website gives you credibility, and reinforces the fact that you exist and are serious about your product.

**Credibility – now that's a costly word.**

By now, we have spent tens of thousands of dollars on this (credibility). The Omega-3 pork products had to be tested numerous times to make sure we had the right levels in the meat. We had to have proof that what we claimed on the label was actually what was in the package. We needed to have third-party audits. All of this credibility comes with huge costs; something my brother-in-law calls "start-up" costs.

**Product Destination**

Bringing the product to the intended market became a huge factor. We live in a small town called Mitchell, population 3,500 – not my intended audience, or so we thought. We needed to travel to Toronto about an hour and half away. We finally got a meeting at one of the independent grocery stores in Toronto, in a very affluent area. We went into the meeting with samples and really no idea what to do or say. The first question they asked us was, "Why is your pork different?" So, here was my big chance, I started to explain about the Omega-3s, the health benefits and the improved flavor. I was trying to be very cautious, as I wasn't sure how they would receive the concept that our genetics gave our pork more fat. Finally, I just came out and said it, "Look, I have fat pigs." They looked at me and said, "Finally!"

For years as producers we have been told to make our pork leaner and leaner, and stupidly we actually get paid more for this. We learned quickly that the trend of lean, lean, lean pork is changing. When you buy a steak you look for marbling, you should do the same for pork! More and more consumers are looking for marbling, flavor and health.

**They don't want the whole pig?!**

For some reason, we thought people would want to buy whole pigs for their freezers, just like we have always done on the farm. However, this is the craziest idea in the world to people who haven't lived in a rural community. We soon discovered that people wanted certain cuts more than others, pork chops for example. That leaves a whole lot of pig left over.

Our freezers were starting to pile up. What do we do with all of this meat? Well, you start to supply sausage for baseball and golf tournaments. Although this did help, this was not the solution. There had to be a better way to move more of this product.

We've all heard the saying, "Necessity is the mother of invention." Rosie, who holds a diploma in food service management, started to experiment in the kitchen. She tweaked an old family recipe, and developed the world's first DHA/EPA Omega-3 pulled pork. We have also developed the world's first DHA/EPA Omega-3, gluten free and antibiotic free wieners and pepperettes – that's right, healthy wieners and pepperettes – to also help with the imbalance problem. Actually whenever we come out with a product it is a world's first. Pretty crazy when you think about it!

**The challenge of pricing the product.**

Since it's a brand new product, we didn't have any benchmarks to go by. We did not want to give up any profit; we wanted to always make money regardless of the commodity price of pigs. So, we started by hanging out in grocery stores and writing down the prices of certain products. Our partner was actually asked to leave a store once while doing this. Finally, we came up with

a pricing formula and product pricing to accommodate the whole chain of supply. Now, we had a product and a price, but nowhere to sell it. Stores were still afraid to try it, or even give us a chance.

**Contacts, contacts, contacts.**

One positive thing we discovered was that people were impressed when the farmer came to these meetings. Did you know that most people in these stores have never met or spoken to a farmer before and we supply their food?? I was not what they were expecting – no rubber boots, pitchfork or straw hat - not to mention that I have a very forward-thinking, value-added, functional food product that I want to introduce them to. Surprisingly enough, these people were really interested in what we as farmers do. More and more, people are interested in where their food comes from, what's in it and if it is healthy.

The food industry is huge, but it seems that everyone knows someone, who knows someone else, and so on. One of our first retail customers was a small butcher shop in Port Carling, Ontario. At first, the owner was hesitant to give us a try, since he doesn't move a huge volume of pork, but finally he gave us what we had asked for, a chance. What we didn't really know at the time was the number of contacts that he has in that area. He has quite a diverse clientele. As a result, from this small butcher shop, we have made contacts with many chefs in the Muskoka area, some of which have even taken time to visit our farm.

I have a cousin who was very interested in our product. She mentioned to me that she knew one of the chefs at Deerhurst Resort in Huntsville. So, she passed along our info and website to a friend, who passed it on to the Executive Chef there. In turn, my cousin gave me the Executive Chef's contact info. And 28 phone calls later, I finally got Chef Rory Golden on the phone. First words out of his mouth to me were, Mr. Hill you are one persistent man, and then we set-up a meeting. I contacted Grand Valley Fortifiers (our nutritional company) and my business partner to go with me to the meeting.

Then, I started to think about what to take for samples. We have given out a ton of pork as samples! It is important for people to see and taste the products. In our case, it is necessary to see if there is a difference in flavor. This is another crucial component of our marketing, another "start-up" cost.

On the morning of the meeting, I packed my cooler with chops, bacon, sausage and pulled pork samples, and headed to Huntsville. On the way, one of the reps from Grand Valley asked me, "What do you expect to happen at this meeting today?" I told him, "I expect Rory to cook and try all of the samples I have brought for him." He looked at me and told me not to be too disappointed if that didn't happen, to which I replied, "I'll be pissed. I'm driving 4.5 hours. The least he can do is try it."

When we all arrived at Deerhurst. I was a little nervous, as I had never met an Executive Chef before, and Chef Gordon Ramsey, who is on TV, seemed kind of intimidating. Chef Rory was awesome. He gave us two hours of his time, and he cooked all of the products I took him. We now supply Deerhurst with various cuts of pork. The restaurants there, actually list Willowgrove Hill Pork on their menu. It's really cool to see your name on a menu. The chefs that prepared our Willowgrove Hill pork samples that day, tasted the product also and said that it is the best pork they've ever had!

When we decided to participate in the Grocery Innovations Tradeshow, to get our name out there, we were looking for someone to cook our samples to give out at the show. We really didn't know who to ask, so I approached Chef Rory, fully expecting him to turn us down, especially since it would mean taking time out of his busy schedule. Much to our surprise, he said, "Yes! Talk about connections! He seemed to know everyone who came around the corner at the tradeshow.

In June of last year, we were honored to be able to serve our pork products at the G-8 in Huntsville. Chef Rory tried to get over a hundred local producers to supply products to the World Leaders with just 28 getting accepted, WGH was one of them. Chef had Willowgrove Hill Omega-3 Pork put on the menu and it was him that did the actual cooking and served the world leaders. Rory told me later that they all loved the concept and taste of the product, especially the PM of Japan. It certainly does not hurt to have connections!

**The Next Wave of Questions**

Chef Rory has and continues to be a great friend to Willowgrove Hill. Before arriving at the Grocery Innovations Tradeshow, we thought things were going very well – we had overcome so many hurdles, and solved so many problems. We thought we were ready. Then from the show came a whole new set of questions, questions that we never even dreamed of. How is your product packaged? What sizes are the packages? What type of processing do you do? How can I get your product in my store? And that's the shortlist. At this point, we were faced with a whole new set of challenges. Where do we go to get these things done?? How do we find companies to help us?? One thing was obvious - the brown butcher paper was not going to cut it anymore. Where do you go to learn about this stuff?? Thank goodness for the Internet, and a few kind people who were willing to help you out. Jan and I often kid each other that our learning curve is not a curve, but a line and it's straight up. We have learned so much, but I know there is so much more for us to learn.

As we tried to figure out the puzzle of packaging and pricing, a new factor kept coming up in our meetings with potential customers: "Do you have federal kill and processing?" Our reply, "We currently have Provincial kill – is that a problem?" Why yes it was.

It soon became obvious that we needed to get to the next level - Federal kill in order to take this product to where we wanted. Wow! That really narrows the options, since there are only six Federal kill plants in Ontario, not to mention the fact that back then most of them were at capacity, thanks to the surplus of pigs due to COOL. What's more, we would need to have our hogs segregated on the line, and tracked through the plant to ensure we were, in fact, getting our own pigs back, resulting in a lot of logistical issues. Fortunately, we managed to overcome these hurdles and are using a federal kill plant just 10 miles away from our barns. Willowgrove Hill products are totally traceable, something that many cannot say.

Once we finally got product into some stores, we started getting questions about POS. I hadheard about PMS, but not POS. We first had to find out what POS was. They are Point-of-Sale items, such as labels, pamphlets, posters, dividers, etc. – another necessary evil of marketing. More "start-up" costs. POS items are very important to Willowgrove Hill since it is a new product. We must try to educate the public, and show them the benefits of DHA/EPA Omega-3 and Selenium enriched pork. Most people don't know what DHA/EPA Omega-3, fish

oil based, organic Selenium and RWA (raised without antibiotics) all means, and how important they are to them as a health-conscious consumer.

We had pamphlets and labels printed, but then thought we should try to get the endorsement of Homegrown Ontario, which we did, along with Foodland Ontario after the first batch of stickers and pamphlets were already printed. So we needed to get another batch printed. This happened numerous times, with different things like Omega levels, and the move to "raised without antibiotics." Now, after many tries we have a CFIA approved pamphlet with all the right information in it, something that was not that easy to do, trust me!.

**Back to pricing**

This is where you can't think like a farmer. We finally thought we had a price figured out, but soon discovered that everywhere you turn, someone wants a piece of the pie. A bit of advice is to start out high. You can always come down, and you might need some extra buffer built in for those many fingers that get into the pie.

The hog price was a heck of a factor to us. Everything is based on the current market price of hogs, so even after we added a premium to our product, we still wouldn't be making any money, and we still had to be conscious of the price the market would bear. Because the hog industry does not have a quota system there are huge swings in our commodity prices. We did not do all of this work to lose money. We are trying to become price-makers and not price-takers. So we set the price realizing that when the commodity hog price moves up and the pork industry starts to actually make money, the price difference between Willowgrove Hill pork and commercial pork will decrease, making Willowgrove Hill pork look even more attractive.

The current state of the economy is not helping. Since our products are premium priced, people may not spend the extra money that they have in the past.

## WHERE WE ARE TODAY

Willowgrove Hill has federally inspected slaughter in Mitchell, we work with a HACCP-approved nutritional company, GVF and HACCP-approved feed mill, MFS, and all of our barns are CQA-approved and the barns all have third party audits done as well by SGS. We test our products regularly. Getting this all done has been no easy feat.

Our products have been listed with Gordon Food Services (GFS). GFS is the second largest food distributor in North America. We are in numerous restaurants in Ontario.

Willowgrove Hill pork products are starting to become available at the retail level. In London at an independent grocery store called Remark Fresh Market. The neat thing about this is that Willowgrove Hill Omega-3 pork has increased their sales in pork by 50% and yet not affected commodity pork sales. The meat manager, Geoff, needless to say is pretty happy with the sales increase. He is starting to see new consumers coming into the store to purchase our product which helps the whole store's bottom line because they are not just buying pork. So this proves that there is a demand out there for functional foods.

We have a small store in our house (remember, not my intended audience). Since opening it (just over a year and a half), our sales have six folded, that's 600%. We sell pork to other pig farmers.

Willowgrove Hill has been focused more on the foodservice market but is planning on branching out to more retail. Getting into retail with such a fabulous product is not as easy as you may think; you need the consumers to drive these types of products.

## CONCLUSIONS

The functional food market is growing at a rate of about 10% per year with Omega-3 products leading the growth rate at about 9% per year. In 2010 it was estimated that there would be 168 billion dollars spent on functional foods.

The United States spent 120 billion dollars on cancer in 2010 and that number is expected to swell to 209 billion in 2012-2013. School boards are starting to implement healthier food choices for students in school cafeterias. Healthy eating trends are here to stay for many reasons.

Developing value-added foods and/or functional foods is not for everyone. If you don't believe in your product or have the passion for your product, you need to think twice about what you are doing. Quite often, when we are in a meeting and I am telling people about our products and our story, they remark about how passionate I am. I have my reasons to be as passionate as I am.

Willowgrove Hill started out as a means to become a profitable farrow-to-finish operation and has evolved into so much since we first came up with the idea. We are evolving into the industry with exports going to Mexico just last month. Marketing your own product never stops.

While I believe we have met most of our objectives, it is a long road to the last one – market share and making more pork producers profitable once again. Hurdles and roadblocks wait for us in the future; however, there is a great deal of fulfillment in meeting these challenges head on and succeeding to the next level. We have lots of reasons for hope and optimism! That's what makes this adventure all worthwhile!