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Improving Quality and Uniformity of Pig Meat with a View To Targeting UK Pigs to the Value-Added End of the Commodity Market

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The views expressed in this report are entirely my own and do not necessarily represent the views of the Nuffield Farming Scholarships Trust or my sponsor.

Introduction

The topic for my Nuffield Scholarship was inspired by a discussion with a major retailer about pork and pork products. The belief of the buyers of this major retailer was that British pork and pork products was poor quality and variable whereas Danish was good quality and not variable. The retailer at the time had a desire to re-launch a higher value range which had to be British and had to have definite better eating quality. The reason for this was that they thought that for the consumer to make repeat purchases it had to taste better from the pork in the "regular" range rather than tasting the same but having a story attached to it such as a different production system. Not long after this the same major retailer launched a product based on a story it was sourced from "outdoor" pigs.

The other aim of my topic was to find a way to link a higher quality product to higher prices for producers. It is important that if we are to add value to the pigs we produce that we link in with it the ability to retain that extra value. It is important that we do not follow the same path that we did with Quality Assurance where we were assured of a premium for taking part and in the end it just became the standard and we still had to compete on price with other countries with lower standards.

My study of quality embraced all parts of the chain – farm, abattoir and processor because they are all very important in the production of the end product but I wanted to specifically find ways for the producer to add value by improving quality.

I wanted to look at this topic from the commodity point of view because I was specifically looking at it from the perspective of the UK industry competing with larger lower cost producing countries. We have had the ability to differentiate our product on welfare grounds but this will be lost to a large extent in 2012 when European welfare regulations come closer to the UK standard. Also as our national herd is so depleted there seems little point targeting our product to the cheap or even regular brands. It would seem sensible to try and target British pigs to the premium markets.

Quality and Uniformity – What is it?

It became more and more apparent as time went on that the term "quality" is not as easily to define as I first thought. Is it flavour, taste, the way it looks or the health benefits a product can provide?

Marchen Hvid (June 2006) at the Danish Meat Research Centre in Roskilde gives a very comprehensive list of the attributes of good quality pork and pork products. She broke meat quality down in to the following components: technological quality, eating quality, nutritional quality, health and hygiene quality, fat content and fatty acid quality and finally ethical quality.

Hvid (2006) described technological quality as; the meat content of the carcase, fat and protein content, meat colour, level of drip loss and pH. Eating quality was described as: tenderness (mouth feel, meat structure), taste, juiciness and appearance. Taste is further defined – the product must taste of pork and be free from off flavour (rancidity, boar taint or "piggy" taste).

Jeff Wood (2006) of Bristol University described a simpler view of quality. He split it in to three simple elements: the taste of meat (tenderness, juiciness and flavour), the appearance of meat (colour and drip loss) and the nutritional value.

Patrick Morel (2006) of Massey University (Palmerston North, New Zealand) defined pork quality as: appearance, flavour, processing and cooking properties, safety and wholesomeness, "friendly" production methods, fatness, nutritive value, and juiciness/tenderness/texture.

Morel (2006) explained that there are several elements to quality – appearance, flavour, processing and cooking properties, safety and wholesomeness, friendly production methods, fatness, nutritive value and juiciness/tenderness/texture. Then, more specifically, there are eating quality characteristics – colour, flavour, tenderness, juiciness and odour. The whole chain contributes to eating quality – producer, processor and cook. Within this chain, breed, sex, nutrition, handling (on farm, transport and abattoir), slaughter (particularly the stunning), carcase (hanging, chilling and cutting), products (aging, packing and enhancement) and cooking are the factors that can all affect the eating quality.

We can see from this brief summary that the general principles of quality are complex but are the same around the world.

We also have to note that part of the perception of high quality is often the result of a successful marketing campaign – there are numerous examples of this to be found when you look at the differences between well-known brands (e.g. Heinz, Walkers) and the supermarket own-brands.

Uniformity does not just apply to evenness in the size of the pigs when they go to the abattoir but also to the sizes of the cuts of meat that are stocked by the retailers and served by foodservice and caterers.

The main aim of the quality game is to try and get more people to eat more pork. And preferably more British pork!

Who contributes to the quality of the product? Most people would list the usual candidates: producer, abattoir, processor but Morel (2006) added cook to the end of this list and I think that is an important factor.

Where are we in the UK now?

Farmer / Processor

The Meat and Livestock Commission produced a document called "Blueprint for Quality British Pork" (see Appendix I) in 1996 and updated in 2002 which lists what they saw as the key requirements for high quality pork. It comprises of a side of A3 which shows a

diagram of the quality chain covering all aspects of meat production: on-farm, transport, lairage, slaughter line, chilling and maturation, carcase/cut selection and cooking. The MLC suggests the benefits that should be seen are: Improved tenderness, less drip, better colour, greater juiciness, better flavour. It's a well laid-out and well thought-out document although the MLC report that the recommendations in it have not been taken up across the industry – producer or abattoir.

The British Pig Executive's Annual Technical Report (2005) reports on the Meat Quality and Human Nutrition project which was completed in November 2003 which looked at on-farm factors affecting meat quality. This study backed up previous research showing that ad lib feeding, high growth rates and reduced age at slaughter improved tenderness.

Projects in the pipeline

The Annual Technical Report (2005) also tells us that "several new projects are being taken forward in the areas of nutrition, best genotypes, outdoor production, husbandry advisory tools for … meat quality".

The BPEX Road to Recovery 2006 – 2009 booklet lists as part of the Future Challenges section "Developing an effective way of measuring the aspects of pig meat products on which consumers are willing to place additional value and communicating that through the value chain. The Future Opportunities still include the ability to use our high welfare standards to set us apart from most other countries even after 2013 when although the EU sow housing rules change they do not become as stringent as those in the UK".

Can we do something now?

As producers we have the ability to immediately improve overall quality of the product produced just by paying more attention to detail. This would have the additional effect of improving an individual's profitability. Such measures include taking care to hit the "hot box" by not selling pigs that are under or over the weight limits. Also, many of the best producers are producing a pig that is 72kg deadweight with a 9.5mm back fat probe. They could improve their profitability by producing pigs that are 79kg deadweight with a 10.5 – 10.9 mm probe which are still within the contract bands (Suckling 2006).

Quality Standard Mark

This is the mark that was launched in 1999 and "provides consumers with assurance about the production standards of the pig meat they buy. It covers three key areas: farm assurance, transportation, slaughtering and processing. The British Meat Quality Standards for pig meat mean: no meat and bone meal in animal feed; no stalls and tethers and independent auditing to internationally recognised standards" (A Guide to Innovative and Versatile Pork Cuts, MLC). There is nothing to accompany these words that suggests pork carrying this logo might also be nice to eat.

Do we really have a problem with quality?

BPEX have been using psychometric measures to indicate how the emotions and values associated with pork are changing. The results of these surveys are shown diagrammatically in the Pork Category Update. They show that consumers are increasingly thinking that pork is a lean meat, a healthy food, part of a healthy diet, versatile and more than just a roast. However on the more disappointing side they also show that people are increasingly thinking of it as tough and chewy. They also see it increasingly as cheaper than other meats – it is more and more being classified with chicken as lower cost and a much more versatile alternative. The number of people who feel that pork can be very dry is not increasing but is not decreasing either and a lot of people still think it needs to be cooked well. It is disappointing to see that belief that pork tastes great and is succulent and delicious is also declining.

We could summarise that as pork is becoming seen as a healthy and cheap but poor eating quality. Is this really where we want to pitch ourselves? It would be better to try to increase the quality and target the higher end of the market.

So yes, it seems that we do have a problem with the quality of pork. I question, however, whether this is confined to British pork. The category update is for pork as a category not British pork as a category. So maybe the same can be said for Danish as well as pork of other nationalities.

However, we have no direct figures that indicate the poor quality claimed by the retailers – it may only apply to 10% of the product (Wood 2006)

What we are up against

The MLC document entitled "The Shopping Decision Tree" tells us "shoppers take an average of 30 seconds to make their selection. This ranges from an average of 24 seconds to buy sausages up to 37 seconds for chops and steaks." The document goes on to say that the time taken by the largest group of consumers to choose what to buy is 10 seconds for all proteins except joints, steaks and chops. For these items the time is 20 seconds. This demonstrates that the product needs to stand out – by looking good and being extremely well presented.

The Study

In order to look at ways we can improve our product I decided to look at countries with mature markets where meat is no longer a luxury and people eat it for more than just to provide them with energy and also on different continents to have the best chance of finding differences.

I initially visited Denmark and Sweden in June 2006 as a trial run for the "big trip" and was then lucky enough to return to Denmark as a guest of the Danish Meat Association in September 2006 to take part in a Danish Masterclass that was being run for people primarily working for companies allied to the Danish pig industry.

For the main part of my study I visited Australia and spent a week in Western Australia and then a week in New South Wales and South Australia, followed by two weeks in New Zealand mostly in and around Canterbury but also in Wellington and Palmerston North. The final leg was two weeks in Canada - a week in Alberta and a week in Ontario

and Ottawa. I met some fantastic people on my travels and everyone was extremely kind and helpful.

So, what did I find out?

Denmark

Danske Slagterier has produced what can be described as a manual called the "Danish Quality Guarantee" (2005) which is aimed at buyers of Danish pig meat products. The manual describes the standard processes of pig meat production in Denmark and covers all aspects from the farm to the abattoir to the cutting plants. They also state that in many cases the standards are even higher than the minimum they describe in the manual. This document also covers food safety and the control of pathogenic, zoonotic bacteria including salmonella and the HACCP principles the industry works under.

Denmark produces 25 million pigs per year and of the pig meat produced, 90% is exported to 140 countries. This is, according to The Danish Meat Association (DMA), because of its high quality and documented food safety standards (Sørensen 2006). Despite the rosy picture painted of the Danish industry it must be noted that the trends in pig production are the same as those here - that there are fewer and fewer pig farms in Denmark – the DMA thinks it is now below 9000 and has fallen from just under 80000 since 1975. However the numbers of pigs produced over this time has increased from about 9 million to around 25 million. Danish consumption is 65kg per person per year including bones – almost 3 times as much as the UK (Sørensen 2006). The Danes are excellent at carcase utilisation and sell all parts of the pig all over the world including heads, tails and feet to China.

The Danes approach quality in a very comprehensive way – they understand that all stages of the production chain are vital to the production of a quality product – farm, abattoir, processor, retailer (Quality Matters, DBMC). They have the ability to control the processes that go on in every step of the chain because they have a fully vertically integrated system and it means that they can ensure everything is being done correctly to produce the best quality meat. It was clear from both my visits to Denmark that quality was the theme that underpinned just about every aspect of the pork chain; not only have the Danes designed their Quality Assurance scheme and implemented it they are using it to "promote continuous improvement in production methods to supply the highest quality meat possible" (Quality Matters, DBMC). They believe that the whole chain – farm, transport and slaughterhouse as well as processing contributes to producing a high quality product.

They also believe that to be able to successfully brand a product the quality and uniformity must be good (Anders Vernersen, Danbred, personal communication, June 2006).

PRODUCTION

Genetics

In Denmark breeding pigs are supplied predominantly by Danbred, a national breeding programme managed by Danske Slageterier through the National Pig Production Committee. They supply 95% of all breeding animals to the Danish pig industry (Quality Matters, DBMC). The National Committee for Pig Production reviews and sets the breeding objectives and performance of the breeding stock is closely monitored and recorded (Quality Matters (DBMC). The result of this is that all the pigs in the Danish pig industry are standardised and very uniform and presumably have similar performance. The slaughter generation are Duroc sired and Large White-cross-Landrace females (Anders Vernersen, Danbred, personal communication, June 2006).

Danbred are selecting for quality and uniformity but only in addition to other factors that affect cost of production. The quality and uniformity elements of selection include (Anders Vernersen, Danbred, personal communication, June 2006):

- Selecting to eliminate the halothane gene (to reduce Pale Soft Exudative (PSE) meat) and the RN- gene which originated from the Hampshire (which causes higher drip loss)
- High lean meat percentage but not at the expense of the performance figures

In terms of the cost of production and performance side of selection Danbred are selecting a lot for increased litter size amongst many other things. They help to ensure good birth weights even in large litters by selecting for breeding stock that have good litter size by counting those piglets that are alive at day 5. This means that any piglets that are really small or non-viable are not counted in born alive which helps to prevent selecting for pigs that produce highly prolific litters but with small piglets. It may also help select for pigs that produce even litters. They are also trying to improve sow longevity through selection of breeding stock because some families show a lot of culling out after the first litter because the sows go barren which is a highly genetic trait. (Anders Vernersen, Danbred, personal communication, June 2006).

Vernersen (Danbred, personal communication, June 2006) captured the uniformity issue very well when he said “it’s not a screw and nail factory, variation will be there as part of the biological process” and the same applies to litter size and slaughter pigs.

Abattoirs also have a feeling for what quality adds value and they set their pig price accordingly. In the 70s when quality was king and high premiums were paid for high lean meat percentage it meant that when selection criteria were being decided food conversion rates (FCR) and growth rates were forgotten about. The Danish pig industry has always had to be competitive and the cost of production is as important as quality (Anders Vernersen, Danbred, personal communication, June 2006). It is interesting that lean meat percentage has been correlated to quality, albeit in the 70s, because this is a fantastically simplified view of quality. The Danes appear to have a much better view now that quality is intrinsically linked to value and that this then goes hand-in-hand with cost of production in the making of a successful industry.

Danbred are also testing foreign dam and sire lines to see if they are any better but they are still using the Danish ones which, they suggest, shows that they are better (Anders

Vernersen, Danbred, personal communication, June 2006). Other non-Danish companies have tried to sell breeding stock in Denmark but have been unsuccessful.

In Sweden they are using the Hampshire to cross between the LW/LR dam line and a Hampshire sire line to produce the slaughter generation. This cross tends to lead to meat with higher drip loss (Marchen Hvid, conversation, Danish Meat Research Institute June 2006). The Danes are so focussed on what they are doing and they, like all the best sales people, completely believe in what they are doing and the product they produce.

Although Danish opinion is that they are not using the best sire line in Sweden at least they are consistently using the same one which means the quality and uniformity will be the same across the industry. The breeding company Q Genetics is a daughter company of Swedish Meats, the co-operative slaughter house, so there are close links between them. This will mean that they are producing the right genetics for the markets they are supplying.

Intra-Muscular Fat

At the DMRI they have studied the effect of the amount of marbling in the meat on tenderness and "roast taste". They have found that the higher the intra-muscular fat the higher the tenderness. The improvement in "roast taste" increases as well but not by nearly as much. They also suggest that the consumer will probably not visually detect the increase in intra-muscular fat needed to improve the tenderness – up to around 2.8 percent (Marchen Hvid, conversation, Danish Meat Research Institute 2006). Their research has shown Duroc pigs to have higher intra-muscular fat than the white breeds.

Welfare

In the Quality Matters (DBMC) publication they devote a section to their UK contract. They are pleased to tell you that the contract for UK production includes "a number of specific requirements enshrined in UK legislation" as also that in addition to this it includes a "range of production standards – several unique to the Danish pig industry" which cover a range of items along similar lines to the other main features of the Quality Assurance standard. They are slightly less enthusiastic about pointing out that farmers producing pigs for the UK contract are still allowed to castrate without anaesthetic which has not been allowed here under our Quality Assurance scheme since the mid 1980s.

Castration

In Denmark they firmly believe that castration is an important factor in quality of the product produced because it stops the boar taint. They are absolutely convinced of this and as such they even castrate pigs on the UK spec contract. Although the Danes do not bring up the subject themselves whenever I asked about it I was told that it was essential and that farmers would like to not have to castrate but other than that it is glossed over.

Ad-Lib Feeding

They have done a lot of work on ad-lib feeding in Denmark and the part it plays in quality. As a result feeding in Denmark is all ad-lib even on the farms that feed their pigs

with wet feed. They have found that they have the best protein turnover with ad-lib feeding in the last part of production. They have also shown that the quality of the diets depend on the sources of the protein and fat rather than just the energy levels. (Marchen Hvid, conversation, Danish Meat Research Institute June 2006).

ABATTOIR

Handling of pigs

If the pigs are handled carefully and gently before slaughter the meat that is produced from them has lower drip loss (Marchen Hvid, conversation, Danish Meat Research Institute June 2006). In the new Danish Crown abattoir at Horsens they have built their lairage to ensure that there is very little stress on the pigs just before slaughter. The passages from the lairage area to the stunning equipment contain moving walls between groups of pigs so that pigs are gently moved along without any need for human intervention. When you stand and watch pigs moving through this system there is absolutely no noise from the animals which suggests that they are calm. The floors in the passageways slope gently upwards as well because Danish research has shown that this also reduces stress.

Stunning

Group stunning with carbon dioxide is the preferred method in Denmark. In the Danish Quality Guarantee (2005) the reasons given for using carbon dioxide stunning are:

- It is wholly effective
- It enables group handling
- It causes minimum discomfort for the animal
- It has a neutral effect on the quality of the meat
- It improves safety for the employees

It is interesting that they refer to it having a “neutral” effect on meat quality rather than saying it improves it. The Danish Quality Guarantee (2005) goes on to say that carbon dioxide stunning has led to a 75% reduction in blood splashing, particularly in the loin and ham, compared to electrical stunning and they also credit it with reducing the incidence of PSE and with reducing the risk of broken bones.

Drip Loss

This is a problem because it results in liquid oozing out of the meat and being left in the packaging. The DMRI have shown that either group stunning or sprinkling the pigs with water while they are in lairage significantly reduces the drip loss of the meat produced (Marchen Hvid, conversation, Danish Meat Research Institute 2006). They have also shown that Hampshire pigs have the highest drip loss and Duroc the lowest with Large White and Landrace in between.

High Voltage Electrical Stimulation

Although Danish research shows that electrical stimulation of the carcase gives a significant improvement in the tenderness of the meat it does not apply to all parts of the pig. High Voltage Electrical Stimulation is not used in Denmark because it makes the

ham less tender which is a high value part of the carcase. If it is to be used it ought to be used on the loin only (Marchen Hvid, conversation, Danish Meat Research Institute June 2006). The DMRI thinks that low voltage electrical stimulation may produce better results.

Aging

Aging the meat produces a significant improvement in the tenderness of the meat. The carcase does not have to be aged while it is whole the same effect can be achieved by aging it as primal cuts in vacuum packs (Marchen Hvid, conversation, Danish Meat Research Institute June 2006).

Slaughterhouse Management

The production of uniform pigs makes processes in the slaughterhouse much easier because they are getting product that is very similar. If however the slaughterhouse receives two pigs from a Danish farm that are different the slaughterhouse is able to make them uniform by matching product of different sizes even if they come from different farms. This is easier when the kill of the slaughterhouse is not less than 30 000 pigs per week (Anders Vernersen, Danbred, personal communication, June 2006). So instead of pigs from a particular farm going on to fulfil a particular contract they gather all the carcases from the pigs from every farm and then allocated them to the buyer according to the specification they require. This is made easier by the size of the Danish industry and by the size of the kill of the individual abattoirs and also presumably because all the abattoirs are working as a team and if one of them doesn't have enough carcasses of the right spec then another one will.

Marchen Hvid (conversation, Danish Meat Research Institute June 2006) doesn't agree, she says that it's not always a question of sorting in the slaughterhouse and matching up cuts of the right size but that the Danes are producing a more uniform quality pig. She illustrated this by saying that nearly half of all pigs produced go to the UK so that, by extension, suggests that those 50% are all uniform. She did however contradict this by saying later on in the conversation that the Danish are very good at sorting out the carcases to give the best value.

Measuring Quality and Value

The Danes have a very narrow weight range where premiums are paid for pigs sold to the abattoir. Premiums are also paid on lean meat percentage which is an assessment of the meat and fat content of the carcase (Anders Vernersen, Danbred, personal communication, June 2006). The narrowness of the weight band means that the abattoirs are receiving uniform pigs. The fact that producers are being paid on lean meat percentage suggests that this is the characteristic that is of greatest value when it comes to selling the product.

Marchen Hvid (conversation, Danish Meat Research Institute, June 2006) has spent time working with the classification of pigs. The DMRI have a new project measuring quality with a scan to find three or four places on the carcase where they can measure the quality and value which are representative to the whole carcase. She doesn't go on to say what criteria they are using for the quality attributes although I suspect they are related to fat and muscle depth.

This is interesting because it contradicts any belief that as the meat gets more and more lean it becomes drier and less juicy when it is cooked.

PROCESSING

Freezing

The DMRC has also done some work on freezing, looking at it from both a cost and quality point of view. They have found that impingement freezing is best for high quality products such as loins whereas plate freezing is best for diced and de-boned meat. The research showed that both impingement and plate freezing would reduce the freezing

costs and result in products that were of better quality (Marchen Hvid, conversation, Danish Meat Research Institute June 2006).

Butchery

Fisker (2006) further confirms the Danish thinking that high quality products can only be produced if the whole chain is striving for it. She said that a lot of work can be done in the abattoir and the chill room to improve the quality but that it can be destroyed in the preparation and cutting.

Five new cuts of pork have been developed to reflect the changes in the way Danish consumers cook and what they look for in a cut of pork. These new cuts have been trimmed of all visible fat but they have not all been a success when it came to selling them. Royal tenderloin, knuckle bites and knuckle flank steaks have been withdrawn but loin medallions, sauté slices and wok strips have been very popular (Fisker 2006).

Fisker (2006) explained the reasoning behind the need for the meat to be correctly cut. It is important because the sizes of the small pieces should be the same every time so that they cook the same. People like to know that when they buy it again and cook it in the same way that the results are going to be the same. This applies to strips, chops and steaks – they must be an even thickness as well. They have produced a book for butchers to follow to ensure they produce cuts to the correct size and thickness (Fisker 2006).

COOKING AND PREPARATION

Instructions

Fisker (2006) explained the importance of having a label on the pack giving instructions about how long to cook the piece of meat for. It is also important that they are appropriate for the piece of meat inside the packet.

Tenderness and cooking methods

This has to go down as one of the British farmers favourites – we all say that pork is only tough and tasteless because people over-cook it. This is a problem that is found in Denmark as well and they are trying to change that. I was taken to a restaurant in Copenhagen that Danske Slagterier had worked extremely hard with and the result was a first class piece of tenderloin cooked so that it was pink in the middle.

Salting

The Danish Meat Research Institute (DMRI) has demonstrated that salting the meat before cooking improves its tenderness. It is sufficient to salt it one hour before it is cooked. A little more tenderness can be achieved if it is salted longer before it is cooked but it depends on the amount of salt used. The DMRI has shown that a small amount of salt only is needed to improve the tenderness. (Marchen Hvid, conversation, DMRI, June 2006). Hvid said that it is possible to salt poor pork to the quality of better raw pork but that if you also salt the meat from the better pig you can increase the quality of it too.

Cooking

Fisker (2006) reports other recommendations for cooking and preparing meat to achieve or maintain a high quality product: Using a temperature probe to test the temperature

inside the joint when roasting to ensure that it is neither under-cooked nor over-cooked, cooking at low temperatures to prevent over-cooking, salting the joint 24hours before cooking so that it is more tasty, more juicy and has less shrinkage. Finally, their research has shown that resting a joint before carving it makes no difference to the eating quality, in fact, if it is rested it loses more juice which reduces its eating quality.

Fisker (2006) also offers advice on the health front as well. She reports that if the meat is being pan-fried the amount of fat you put in the pan doesn't matter because it stays there when you serve it and has not been absorbed by the meat. If however the meat is going to be stewed afterwards then it is important not to add too much fat to the pan because it is all transferred to the stew. She also is keen to point out that you get good protein from meat. The protein in pork makes you burn more energy and makes you feel fuller.

PROMOTION

The Danish Meat Association has several campaigns running to promote pork. They have a recipe book of fifteen favourite recipes as well as adverts and a website (www.15opskrifter.dk) which are all used to promote pork and pork products in Denmark.

The promotion of Danish bacon in the UK is relentless and they had a campaign from March to September 2006, costing a massive £1.2 billion, which built on the original, very successful, "sizzle" campaign. They were aiming to build on existing brand recognition and were targeting a very specific market (28 – 44 yrs, ABC1, food lovers). Their strategy involved big colour posters on the London Underground, a series of radio adverts, adverts in various "high-end" magazines like Hello, Cosmopolitan and BBC Good Food Magazine as well as continuing to sponsor the breakfast show on Classic FM (Meat Trades Journal, May 26 2006).

The big advantage that they have in all their marketing is that the have "Danish" as a brand that enables consumers to be able to easily link the product on the shelf with the advertising they have been exposed to. The media they have chosen to advertise in shows that they are targeting the higher end of the market; those people who are prepared to pay a bit more for their food and not just buy the cheapest.

The importance of the existence of the Danish brand is shown by the fact that recent research with focus groups showed that the "Danish 'sizzle' represents the 'seal of approval' and the 'standard' for quality bacon" (Brian McCarthy, Advertising and Promotions Manager, DBMC in Meat Trades Journal 26 May 2006).

It is important to remember when people are quizzed about bacon and advertising in focus groups, if you asked a hundred people to name a brand of bacon I would be prepared to bet that 99.9% of them would say Danish because it is just about the only branded bacon. So when they are asked about what comes to mind when they think of good bacon it is likely that more often than not they mention Danish. This does not mean its necessarily better it just means it's a well-known brand.

The Danes are marketing their product within Denmark in a similar way to BPEX in the UK. They are finding similar trends now appearing in the younger generation that we have seen here. They are moving away from home cooked meals to more ready meals and eating out. They are targeting their marketing accordingly. They are producing recipe leaflets and leaflets on the healthy aspect of pork including an excellent one that shows how complete meals which include pork compare in terms of calorific intake with things like popcorn, sweets and fast food.

In Denmark they have strict medicine control legislation to reduce the amount of medication used, a salmonella control programme, and track and trace system to make sure that the meat they produce is fully traceable (Sørensen 2006). This all contributes to what we can call the ethical quality of the product. The final slide in one presentation simply read “Danish pork – Safe, clean tasty” which sums up what they are achieving by focussing on these elements.

The size of the Danish industry and its importance to the economy means that it is important that they maintain their market share and they are constantly marketing their product by promoting every aspect of the industry. Danske Slagterier has even produced a booklet entitled “The Danish Pig Industry – A Strategy for social and environmental responsibility within a market economy” (2005) which covers the broader issues of welfare and environmental responsibility and explains what improvements they have made and what their future targets are. The very existence of a document like this shows how seriously they take the promotion of their industry.

Australia

Background

The consumption of pig meat per capita in Australia is 21.5 kg per year and apart from showing a slight dip in 2004 from 2003 it has been rising steadily since the mid-70s. It is, however, nearly a third of the per capita consumption of Denmark. Fresh pork consumption in Australia was 8 kg in 2002 and is now 9.5kg and is ranked third behind beef and lamb. The average deadweight of pigs slaughtered is approximately 72.5kg and 5.3 million pigs are produced annually. In 2004 there were 1999 pig herds with a total of 318000 sows and average herd size of 159.1. As with many other countries the number of producers is falling and average herd size is increasing (Australian Pig Annual, Australian Pork Ltd, 2004).

Australian Pork Ltd (APL) is a similar organisation to MLC / BPEX and is funded primarily through statutory pig slaughter levies.

Australia has extremely strict import rules designed to protect them from diseases that are not present in the country. This has a mixed effect – they do not have Porcine Reproductive and Respiratory Syndrome (PRRS) or Post-Weaning Multisystemic Wasting Syndrome (PMWS) but the disadvantage is that they cannot import breeding stock or semen so the Australian genetics are not as advanced as you would find elsewhere in the world. They are also not allowed to import fresh pork or pork products. Imports from any country with PRRS or PMWS have to come in boneless and imported meat may only be used in the manufacturing sector where certain lymph nodes are removed and the meat is cooked – like salami or cooked ham. This has the advantage to producers that they are shielded from competition in the fresh pork sector.

Australia imports 75000kg pig meat – middles from Denmark for bacon and legs from the US and Canada. Sixty percent of bacon and ham is imported and the packs have to be labelled as containing imported product. Seventy percent of bacon and ham is sold loose through the deli counter rather than pre-packed.

Sixty percent of Australian pork goes into small goods and forty percent is sold fresh so an increase in the amount of pork imported does have a downward effect on the price.

Producer prices for fresh pigs are the highest they have ever been partly because exchange rates have gone the right way (as at November 2006). If prices stay high throughout the summer (Dec 06 / Jan 07) APL think the industry will be OK but if not they will struggle. Like us, the Australians see a dip in the price received for pigs after the Christmas period.

The Australian pig industry is facing some significant challenges as a result of the prolonged drought. At the moment feed accounts for 60 – 65% of the cost of production – at the time of travel (November 2006) at $180 - $200 per tonne. It has gone as high as $320 and they are expecting the price to rise to $280 - $310 per tonne of feed. The only feed grain they can get at the moment is second rate because it is that which has failed to meet the export standard.

In the current climate with the continuing drought no one is prepared to increase their sow numbers. If they can achieve some kind of sustainability they may invest and expand slightly but not invest heavily.

Pigs are only found a maximum of 15 degrees N but generally from Brisbane south and they are usually situated in the grain producing areas.

The pigs are now mostly sold to supermarkets at least cut in to primals.

Perceptions of Current Quality and Uniformity

There have been problems with the product being inconsistent as well as problems with consumer perception. Consumers perceive pork to lack juiciness and tenderness and to be not easy to cook. One of the ongoing campaigns for APL is trying to educate people that cooking pork is like cooking beef but you need a medium heat and "getting guys to turn the heat down is hard"!

It is the belief of APL that the biggest problem with quality is the genetic range. The majority of the pigs are PIC and because of the import restrictions they have not been able to import any new and improved genetics. They are looking at the possibility of bringing in frozen embryos that have been cleaned to minimise the risk of importing disease.

The Australian pig industry has difficulties getting the space in the supermarkets consistently filled and as the supermarkets are not able to import fresh product they presumably remain empty.

Australian Pork Ltd is finding that the cuts of pork and pork products are becoming more consistent in size than they were which suggests that the pigs are becoming more uniform.

Of complaints received 2 – 3% are about boar taint – the meat having an unpleasant smell and taste but this accounts for only 1% of all registered complaints. The Australian industry's method of controlling taint is by keeping the carcase size small. They have found that deep litter housing helps and that the number of complaints has decreased as the proportion of deep litter housing has increased.

PRODUCTION

General Production Notes

The climate in Australia is not conducive to high quality pig meat production and makes life difficult for producers. Summer infertility can reach levels so high that resultant farrowing rate is 40%. Weaning has to be done on some units at 4am before it gets too hot. One of the pig units I visited had an average of 10.5 piglets born alive per litter and 9.5 pigs reared per litter. This compares favourably with the national average. They are also facing a very serious situation with the drought, which is putting the price of feed up to ridiculous levels. However, having said that I visited a pig unit near Adelaide producing 7 kg weaners at 21 days and the unit was tremendous – and no mud and no additional water from rainfall in slurry tanks! The lack of new genetics was clearly

limiting production but the advantages of selling into a market closed to outside competition in terms of fresh meat has very significant advantages.

Genotype

A National Genetic Evaluation Programme was carried out in Australia and some interesting findings were made. They found that sow parity had no influence on meat quality traits. They found that sex significantly affected some of the traits measured meaning that females generally had heavier carcase weights, higher P2 measurements, more intra-muscular fat and lower cooking loss and pH. They have found that pigs from purebred Duroc sires have significantly higher intra-muscular fat and the meat from those pigs is more tender than that from pigs sired by other terminal sire genotype groups (Bunter and Bennett, 2004). They also found, not surprisingly, that P2 measurements and intra-muscular fat levels increased with carcase weight and also that the higher P2 measurements meant darker meat, higher pH and higher shear force values. This study also found that cooking loss was highest for LW, intermediate for Duroc and lowest for Landrace sired pigs (Bunter & Bennett, 2004).

Welfare

Surgical castration is legal and practised in Australia but not across the entire industry. I was given different opinions about how much of national production is surgically castrated. As castration is such a big topic I have dealt with it in a separate chapter.

Sow stalls usage is under review and it may be changed so that they are allowed 6 weeks from service. At the moment it is supposed to be 10 – 12 weeks maximum but it is very unclear so they can keep them in for the whole of pregnancy (APL, conversation 14 November 2006, Canberra, Australia). While I was in Australia a pig farm in South Australia that is partly owned by a rather unpopular politician was broken into and the animal rights protestors chained themselves to the sow stalls. This was not the first time it had happened and it has brought the issue to the forefront and the current situation is almost certain to be changed.

pST

A characteristic of leaner pigs that efficiently produce high-quality lean pork is that they have higher levels of the naturally occurring hormone somatotrophin (growth hormone). It is also reported that it has been known for several decades that injection of pigs with tissue extracts containing porcine somatotrophin (pST) results in increased lean tissue deposition and decreased fat accretion in growing pigs. Advances in biotechnology have provided a means of producing pST on a commercial scale and the efficacy of a daily injection of it to improve productive performance in pigs is beyond doubt (Dunshea and Gannon (1995)).

Porcine somatotrophin started being used in finishing pigs in Australia 5 or 6 years ago. The use of pST increases lean meat deposition by 25% and reduces fat deposition by 30%. When a pig is produced using pST it has better muscle and less belly fat. The disadvantages of it are that it needs to be injected every day and as a result a lot of producers are giving them a double dose on Monday, Wednesday and Friday. There are also a lot of people who just give it 6 days a week but neither of these methods are

as good as the daily dose (Bruce Mullan, Medina Research Station, WA, 6 November 2006).

Paylean

Paylean can be loosely described as a feed additive and came from the States two years ago. Paylean is the trade name for Ractopamine which is a beta-agonist and it increases the width of the muscle fibres. One of the acute actions of beta-agonists on fat tissue is to decrease fat synthesis and to increase fat breakdown (Dunshea and Gannon, 1995).

Its effects are that it improves Food Conversion Ratio (FCR) and muscle growth but there is no change in the fat levels. The advantage of using Paylean is that you might still sell the pig at 70 kg deadweight but it will be younger. Most people say they can produce a 72 kg pig using Paylean at the same age they were producing a 70kg pig without it. The real advantage of Paylean is seen in a batch situation where it improves the tail-end of the pigs – the sale of the pigs in the batch can be spread over 3 weeks with the use of Paylean instead of 5 weeks without it. When producers started using it they saw visible effects because the hams on the pigs were noticeably bigger (Bruce Mullan, conversation Medina Research Station, WA, 6 November 2006).

Using Paylean at 20ppm in the feed gives a very good improvement in carcase confirmation but at $160 per tonne it is very expensive. The most effective way of using it is to put it in the feed at 5 – 10 ppm for four weeks but no longer because otherwise the response ceases (Bruce Mullan, Medina Research Station, WA). Dunshea and Gannon's (1995) research demonstrated this and they report that these beta-agonists need to be used strategically because the responses decrease with time. They also report that it has the greatest response in gilts and barrows (castrated males) (although even in boars substantial improvements in protein deposition can be achieved) and that it appears that the responses are greater in leaner genotypes.

If Paylean is being used then particular attention needs to be given to ration composition. In order to maximise the performance and protein deposition of pigs treated with Paylean there needs to be an increase in the protein levels in the diet commensurate to the increased deposition of protein (Dunshea and Gannon, 1995).

Some people are using an inclusion rate of 5ppm to start with and then moving to 10ppm but this is difficult because it requires a change in feed.

The majority (60%) of Australian pig producers are using pST and 20% of producers are on pST. (Bruce Mullan, Medina Research Station, WA). APL, however, reported that hardly any producers are using Paylean. This may be a reflection of the difference between Western Australia and the rest of Australia or a demonstration of the common fact that if you ask two people the same question you get different answers!

It is highly unlikely that the British consumer would find the use of the hormone pST or Paylean acceptable in the production of pork in the UK. It must be remembered though that it is possible that at some time in the future we may be expected to compete on price with countries that are able to have the advantage of this type of treatment.

ABATTOIR

Abattoirs in Australia are similar to those in the UK. In comparison to the abattoirs in Denmark they are small and unsophisticated but that is not surprising and says more about Denmark than Australia.

The Australian industry is small and as you might expect it is very spread out. The abattoirs are small in many parts of the country and do not have the advanced technology you would find in the Danish abattoirs. The abattoir I visited in Australia was a good abattoir but it felt as though there were some inefficiencies.

Transport and Lairage

The pigs arrived in trucks (and not 'lorries' as I was quickly told!) which have no protection from the elements either on the sides or the roof. In the height of an Australian summer it meant that the pigs would overheat and get sunburnt. The pigs were not loaded on to the lorry in stable groups and each pen on the truck held 4 or 5 pigs. On arrival at the abattoir they go into reasonably large fully slatted pens where they wait for 2 hours before they are killed. The lairage was equipped with drinkers and the pigs were sprayed with water. They went up a ramp from the lairage to the stunning area. The ramp was as you would expect – a continuous flow race on an incline. The person guiding them up the ramp has an electric goad which he is not allowed to use until they get over the top of the ramp but on the day I visited he was clearly using it earlier. They are supposed to use a stick with plastic strips attached to the end, which is designed to be noisy rather than used as an implement.

Stunning

The pigs at this abattoir are stunned in groups of 3 using carbon dioxide. They have an electrical stunner on standby in case of a failure of the carbon dioxide stunner. They reported that if this has to be used they can see burst blood vessels in the hams so they prefer not to use it.

Grading

As a country they are changing the way pigs are classified from measuring the depth of fat at the P2 point. It has been found by APL that the Autofom grading equipment is too expensive so they have opted for a hand held scanning system that scans right round the carcass to the belly. They are hoping that this will mean they are better able to place the right primals in the right market more like they do in Denmark.

Australian producers receive a 20% penalty if the pig grades at more than a 12mm measurement at P2 so this is a major incentive to produce lean pigs.

Electrical Stimulation

They were not using high voltage electrical stimulation but were doing some work on low voltage stimulation.

Chilling

They have changed the way they chill the pork because the Singapore market requires the meat to be darker but the skin colour to be quite pale. To achieve the darker meat they do not use blast chillers, instead they chill it slowly over 14 hours to about 5°C or so. To preserve the pale skin colour they thoroughly wet the carcase before it goes into the flame-thrower de-hairing machine so that it does not burn or colour the skin.

Butchery

There was a high manual labour input and most of the work was still done with knives and band saws although they were using a circular saw to cut the sides into primals because it reduced the amount of bone that is sprayed on to the meat and this increases the shelf life. The circular saw has to be lined up by hand.

Quality and Uniformity

John Thompson of PPC, who produces Linley Valley products, reports no issues with quality and uniformity, other than "the odd fat pig" even though there were significant differences in the carcase sizes he was receiving – his comment was that you just have to live with it.

PROCESSING

Another of the abattoirs I visited was selling 30% of its production to Singapore; Qantas flies the meat there fresh. A further 10 – 20% is sold into the restaurant trade and the rest is sold to supermarkets and the foodservice industry.

Although the slaughter side of the business did not seem to be very advanced the work they were doing on the actual products they produced was very impressive.

They have developed some moisture-infused pork products, for example, a loin rack and a boned loin. All the visible fat is trimmed off and then the loins go through an injector machine which injects a brine solution. The machine is similar to the machines used to make bacon with lots of needles injecting the solution into the meat. The machine is carefully calibrated so that it injects the meat with 12% brine solution, the meat is then left to drain and the resulting product contains 10% water. Some of these products are then rolled in a dry marinade and vacuum packed and branded with the Linley Valley label. The result is a product that looks fantastic and would make an excellent mid week meal solution because all you need to do it remove it from the packaging and cook it. In fact, they market it to retailers as "these products are targeted at the consumer looking for a ready-prepared simple 'take-home-and-cook product". They do 7 different marinades: Tomato and Mustard, Tandoori Spice, Mexican Style, Szechuan Style, Sweet Thai Chilli, Greek Style, Picked Pork. They report excellent sales in restaurants and supermarkets where the packs fly off the shelves. They have also started an un-marinated moisture-infused product (branded Truly Tender) but it is not nearly as successful. At PPC they are moisture-infusing shoulder, leg, belly and loin. They are adding value to low value cuts like shoulder by boning and rolling them and then moisture infusing them. They then end up with a value added product from a low value cut.

John Thompson, who is in charge of product development and innovation said that moisture infused pork shouldn't be cooked slowly it should be fried or barbecued – anything that is quick.

Meat is already being exported to Hong Kong, Thailand and Singapore by PPC and they would like to expand but they have trouble getting enough pigs to put through their boning room and have to share the pigs out among their existing markets. There is a major supply problem caused by lack of pigs. Had feed prices not rocketed there may well have been an opportunity to either own some sows themselves or enter in to some kind of cost-plus supply agreement to guarantee them a supply of pigs.

PPC already has a market for a large number of bellies and this is made more economical now they have this line of bone-in and out loins. If it weren't for this market they wouldn't cut the middles at all so they are adding value to the whole carcase.

PPC is also trying to find ways to introduce flavour to the brine that is infused rather than having to use dry marinades. They have tried sauces but they don't go through the needles well and it is difficult to control the amount of flavour the meat receives. They have tried using coriander but this doesn't work either because it blocks the needles. They have also tried including pouches of marinade and flavour inside the pack but this has not been successful because the consumer doesn't want the hassle – they just want to be able to open the pack and cook it as it is.

Moisture Infused Pork

APL developed Moisture Infused (MI) pork to provide high quality pork with improved eating quality for consumers. It is fresh pork that has been infused and processed with a solution of water and salts. The resulting meat is juicier, more tender and more flavoursome and is easier to for consumers to cook without drying out (The Facts on Moisture Infused Pork, 2006).

There are 3 or 4 different brine mixtures in use in Australia. The idea is to buffer the pH of the pork and the five factors that affect eating quality are altered in different ways depending on the ingredients of the brine (Barry Lee, APL, conversation, 14 November 2006, Canberra, Australia).

The moisture infusion process works best with good quality meat; MI will not improve poor quality pork or pork that has the incorrect pH.

Benefits

There is enough technical information on moisture infusion to say that it produces technically better meat. Moisture infusion improves eating quality more than the total of the next 6 things including high voltage electrical stimulation and aitch bone hanging (David Mogford, APL, conversation 14 November 2006, Canberra, Australia).

The benefits of MI pork, according to APL are that it has more tenderness, moisture and flavour. They say in their leaflet The Facts on Moisture Infused Pork (2006) "some consumers tend to overcook pork. Pork has been intentionally developed as a lean meat to successfully appeal to health-conscious consumers. Moisture Infused meats retain more moisture, even when overcooked, resulting in a more tender "mouth feel". Infusing pork significantly adds moisture and flavour to meat."

This leaflet also tells the consumer that "MI pork is ready to cook, easy to prepare and tastes good to the average consumer under a range of cooking conditions and skills". Consumers are spending much less time preparing meals than they did 20 years ago and many people lack confidence in how to select and prepare meat. This product is extremely suitable to be used as an ingredient for a quick and easy meal.

Labelling

It is important that MI pork is clearly identified on the packaging because it looks identical to non-MI pork. The food authorities and the consumer watchdog, the Australian Competition and Consumer Commission, are concerned that consumers may be misled if it is not identified. Australian Pork Ltd believes it should be labelled as MI so that consumers can easily identify it and understand the product benefit*s* and can then re-purchase easily.

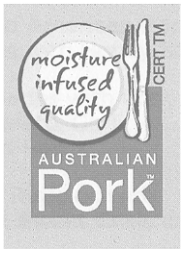
When moisture infusion was developed it was called that because APL wanted a descriptor that didn't describe the process. They didn't have to label it as infused by law but the packaging couldn't be misleading either. They needed a descriptor that would promote it as delivering an eating quality improvement rather than being a weight issue and they thought that the term "moisture infused" did this. The packaging has the brand

name and “pork” then underneath it will say Moisture Infused (David Mogford, APL, conversation 14 November 2006, Canberra, Australia).

Development and Integrity

When APL were developing moisture infusion they wanted to set a minimum standard so that they could control how the major processors carried out the procedure to ensure that the integrity of the product that will carry the logo is not compromised. These guidelines are not only good advice about best practice but they are also about food safety. They wanted minimum standards on food safety and would license reputable people to carry out the process to enable people to differentiate between them and the backyard people.

In order to preserve the integrity of the MI pork brand that APL has created they have introduced a Quality Assurance Manual that covers the processing and food safety standards for MI pork. They have also developed a Certified Trademark (below) which identifies products that have been produced by companies that have been licensed by APL for producing it according to those quality standards. As part of these standards the maximum water level that is allowed in the products is 15% but most people are only going as high as 10%.



Australian Pork Ltd has pledged to work with suppliers and retailers to help develop and market their moisture infused products and they offered funding in a 50:50 ratio to people who wanted to embark on this process. They worked with the major processors and although it took them 2 years to get them onboard there are now 6 or 8 processors licensed by APL (David Mogford, APL, conversation 14 November 2006, Canberra, Australia).

Butchers and Foodservice

A retail butcher in Sydney (Bush’s Retail Butchers) has started to stock moisture infused product and it has been flying off the shelves. They have also started to sell marinated MI product and sales have been unbelievable. They have been so successful that the red meat industry has been tracking sales.

Originally butchers were not keen on selling MI pork because they thought it was something to do with the supermarkets. Once they did start to sell it they were happy because pork is 9% of butchers’ sales and has a bigger margin than beef or lamb so if they can double their sales their margin increases and they increase their profits.

When MI pork was launched in the US it took off in consumer markets but not in Foodservice. APL were keen to make sure this was not the case in Australia and have had a major promotion campaign in this sector and have persuaded famous chefs to use it and recommend it (David Mogford, APL, conversation 14 November 2006, Canberra, Australia).

Marketing

When MI pork is promoted they explain to the consumers that they should expect to pay a slight premium because it is a "value added product involving specialised production that delivers a consistently excellent eating experience". This would be difficult for BPEX to achieve in the UK given our relationship with supermarket retailers. The Australian retail network is a bit less pressurised – they are less advanced in their competitive techniques and are under less competitive pressure because there are only 2 main supermarket chains. They also do not have the same competition we have for shelf space from other countries because they are not allowed to import fresh pork.

Evaluation and Consumer Research

Before the products were launched APL did a massive amount of consumer testing. If the consumer was only shown the label they expressed concern about the water and salt content so it was necessary to give them a description of the process. Once the consumer panel had eaten the product the conversation changed; they became less concerned by how it was produced because they noticed that it was a better product.

Sensory research was carried out by APL with regular and MI pork which was then compared with lamb, beef and other meats. They found out that of the six cuts that came out on top four were infused pork and the next were lamb chops and chicken breast.

Market research has found that although consumers have had initial questions about what the product contains sales have been very strong from those butchers who have clearly identified the pork as moisture infused. They have recommended that when asked the butchers should say "it is pork which is extra juicy and tender because it is moisture infused with water and salts". It has been shown this approach and explanation has been very successful and reassuring to consumers because they are very attracted to the eating quality claims and it helps to answer the questions they have about what MI involves. Research has also found that if consumers are aware that the pork is moisture infused and have cooked and eaten it they quickly convert to being loyal to that brand. The result has been that 95% of people who tried the moisture infused pork said it was better than the pork they normally buy and no one said it was worse than their usual pork.

The biggest response people had to it was that it was easy to cook and better then non-infused because that was easy to overcook. When people heard that it had added water they thought it was chemicals but when they learned it was salt they were happy with that. Sodium content is not currently an issue in Australia and MI pork is classed as a low sodium food and has been accepted by the Australian Heart Foundation (David Mogford, APL, conversation 14 November 2006, Canberra, Australia).

Examples

I met with Rini Margauwinny who works for Venturetech which is the company that devised the MI technique. They sell the brine for the MI process to many different places. They have reduced the amount of salt in the brine because they found that if the pork had no further marinade it tasted salty. They had been using the MI technique in lamb and beef for a long time but not so much in pork. They had had some problems

with consumer misperception similar to the reaction there was in the UK where people saw that it was only 85% meat content and thought it was being pumped with water to increase the weight alone. Rini told me very enthusiastically how she moisture infused pork in their small research and development plant on a small scale for people who asked for it. She said it was very popular and people would buy as much as she was prepared to make. Then when we went to meet with someone else in the university his PA quite unprompted asked Rini if she was doing some for Christmas and then proceeded to tell me how her MI pork is the best and once you've had it you won't want any other!

While I was in Adelaide APL suggested we went to eat at a restaurant called the Lido, which was selling APL's MI pork. I have to say that it was absolutely excellent and was just as APL said it would be – it was also served pink. APL has worked really hard with this restaurant to make it so this pork dish is excellent and not overcooked and it seems to have paid off.

Drawbacks

The drawback I see of MI pork, in this increasingly salt-aware climate, is the sodium content. Australian Pork Ltd says that the nutritional profile of MI pork is similar to other fresh, lean pork with the exception of the addition of sodium and phosphate. They believe that the resulting sodium content makes it a "moderate sodium food" that is very comparable to other foods. Their consumer research has shown that people (even those who had some concerns about the salt content) just said they wouldn't add any salt to it when cooking. However, we have yet to see how people change their buying habits since the introduction of the traffic light and other similar food labelling methods introduced in the UK that highlight things like sodium content.

Discussion

I think this really captures the concept and essence of MI pork. The ultimate conclusion I have come to is that the pork with the kind of health benefits we have been talking about where pork has less fat than lean chicken and a straight, unadulterated pork product with a really high eating quality are mutually exclusive particularly when the lean pork product is cooked in the way in which people tend to cook pork i.e. too much. Therefore, until we have persuaded people to cook pork less we need to moisture infuse it to improve the eating quality. The other way to improve the eating quality is to move away from the lean angle and move more to the Canadian way and increase the amount of intramuscular fat. This is because intramuscular fat improves eating quality. Therefore, the solution might be to have a two tier pork product one that is low in fat and easy to cook and good for a mid-week solution that can compete in the market place with chicken and a second one that is hung for longer and has more intramuscular fat and has a better eating quality and costs a bit more but competes with beef as a meat for a Sunday or a special occasion.

PROMOTION

Australian Pork Ltd has produced some excellent leaflets along much the same lines as some of those produced by the British Pig Executive – in fact they are so similar it's almost uncanny! For example: Lean Australian Pork Recipes, a Barbecue recipe leaflet entitled "Get some Pork on your Fork", recipe leaflets for midweek pork roast, Christmas

ham leftovers, Christmas pork roast, summer pork recipes and so on. They have the industry logos on them for either the New Fashioned Australian Pork with "grain fed" written underneath, Juicy Tender Pork or National Heart Foundation Approved.

A booklet entitled "Don't let these juicy recipes get away" (see Appendix II) has been produced by APL which deals with some of the issues we also have in the UK. The first page says:

> "Remember everything you've been told about pork? Well, don't.
> You think pork's fatty? Think again. Lean pork actually has less fat than skinless chicken.
> You think you have to cook pork right through? You don't. You can enjoy it juicy and medium rare if you like.
> You think pork's old-fashioned? It isn't. Try the simple and delicious recipes in this booklet"

This captures excellently the whole essence of the way in which we need to change people's perceptions. The picture that accompanies it shows a fantastic picture of a pork dish where the pork is clearly pink and the "Juicy Tender Pork" logo is emblazoned on it as well.

The Australian approach to quality is to focus on the healthy attributes of pork and improve eating quality by either moisture infusing it or by strongly encouraging people not to overcook it. They have had a similar problem in Australia with the image of pork but in the latest figures APL have from their consumer research 35% of those questioned thought pork was healthy (Peter Smith, APL, conversation 14 November 2006, Canberra, Australia).

A company called Masterfoods has worked with APL to develop stir-fry sauces in packets (Appendix III). They took this product to Woolworths (a supermarket - not the same as our "Woolies") with Masterfoods and said that if they sold it at a certain price, put it near the pork in the store and advertised it as just needing to have pork added to it, it would improve sales (Peter Smith, APL, conversation 14 November 2006, Canberra, Australia). The idea is to create an easy meal solution by selling a sauce to which you just add pork.

Linley Valley is a brand owned by PPC and John Thompson is employed to go out and market the value-added products to restaurants and retailers. They have been helped by APL's big campaign promoting moisture-infused pork. A promotional event called Pork Star was put together with their help to which they invited butchers and chefs from local restaurants. The products were cooked for them and given to them to taste, which is a much better way of promoting their products than just handing out leaflets. They can also see as many as 80 chefs at a time which it much more efficient than going to see each one individually. The result has been a big uptake in the product. It has been found by PPC that selling moisture infused pork has been made much easier with the backing of APL. The Pork Star promotional booklet that APL has produced is telling butchers that selling more pork could significantly impact their bottom line because "pork=profit". The four tips that they are suggesting for growing their pork sales are: infused pork (moisture infused, a new and exciting product), value added meals (pork is very versatile and provides great new meal ideas), giving cooking advice using the APL point-of-sale literature to help and finally great staff and use the information available to help train them. They demonstrate that it is possible by showing a picture of a Sydney independent butcher who has managed to more than double his pork sales in the last 2 years.

Retailers

It has been recognised by APL that they need to satisfy the producer, processor and the retailer because they are all part of the chain and they all need to have profitable businesses.

They were just providing stickers to retailers to put on packaging and doing product demonstrations in store but have changed their approach and are now adding value to retailers' businesses. They are working with them to raise the retail price by cutting the pig differently and selling more steaks and chops. This makes the pig more valuable (than if they were selling it as joints) so they care more about it because it is more important to their business. If the retailer is selling more steaks and chops it suggests the consumer is using it more as an everyday meal rather than a special occasion meal (Peter Smith, APL, conversation, 14 November 2006, Canberra, Australia).

They have also worked with the retailers to increase yield and maximise carcase utilisation by cutting the pig differently. They have also introduced new cuts to make better use of the pig and improve sales of parts that are usually slow to sell. For example they have introduced forequarter chops (Peter Smith, APL, conversation, 14 November 2006, Canberra, Australia).

The way supermarkets are run in Australia is not quite as slick or as sophisticated as in the UK which made a refreshing change! At the moment there is a lack of demand for shoulders and this is stopping the retailers buying more pigs because they currently buy

whole pigs (as primals) but they may have to move towards buying part pigs so they can just buy the primals they have a market for (Peter Smith, APL, conversation 14 November 2006, Canberra, Australia). I do question, though, whether this would just move the problem to a different part of the chain.

They are using a co-funding approach to marketing and give Woolworths $400 000 to promote Australian pork in campaigns. Also, Woolworths gave APL $100 000 last year and agreed to run campaigns together to increase the value of the pork products.

They work with the retailers in a number of ways including looking at planograms – which show how the products are laid out and which layouts work best (Peter Smith, APL, conversation 14 November 2006, Canberra, Australia). I went to visit supermarkets with APL in Adelaide and they explained to me that the two major supermarkets lay their meat products out differently. One lays them out, as we would expect, grouping them by species, the other groups the products by size. So for example, people could decide that they want a small individual portion sized piece of meat for dinner and can go and look in the section that has pork chops, lamb chops, steaks and so on and then decide which type of meat they want to buy. In the other system people have to decide the species first then decide on the cut. The layout by species is much preferred by APL but in my mind I can see the advantages, as a shopper, of the layout by size of cut.

This work that APL is doing with retailers is excellent and it will have a real effect on the price of pigs in Australia because they only seem to be working in this way on fresh pork. The reason for that is probably because they are not allowed to import fresh pork – all the fresh pork you find in supermarkets is Australian. This means that when APL do this work and manage to increase consumption, the only producers that can benefit are Australian. If they improve the consumption of the smallgoods market they may just increase the number of imports. As currently 60% of Australian pork goes into smallgoods and Australian pig production is unlikely to increase in the current climate then if they can increase the fresh pork consumption then more Asutralian pigs will go in to fresh pork rather than smallgoods.

Branding

Linley Valley pork is an excellent example of how branded pork products can succeed in the marketplace. A producer, at the instigation of his vet, originally established Linley Valley in conjunction with a processor and the brand was subsequently sold to that processor. It started as 8 producers, with 8000 sows between them, producing pork for the Linley Valley brand. They put together a set of production criteria based on what they were already doing. They needed to be a specific genetic base (PIC – because that's what they happened to have), the pigs had to spend some time in straw-based housing, it was preferred for them to a feed supplement (Magnesium) although it wasn't compulsory. When they arrived at the abattoir electric goads were forbidden to move pigs with and they had to be stunned in groups with carbon dioxide.

The other production criterion was that the pigs also could only be female or surgically or immunologically castrated males. At the time the Western Australia market meant that all the females were being sent to Singapore and no one was castrating surgically so nearly all the pigs that went in to the Linley Valley brand were immuno-castrated. When

the contract was first set up they were paying a premium of $4 per pig, which covered the cost of the vaccine even without any of the other reported production advantages.

This brand has continued to be successful and evolve as has already been discussed. It is marketed as being local and grain fed.

New Zealand

Background

Market size

The total meat expenditure is $2.2 billion. The total meat consumed per person per year is 102.5 kg and total pork consumption per capita is 20.8kg, which has risen by 4kg in the last 4 years.

Production

Pig producers are represented by an industry body called New Zealand Pork Board. This is similar to Australian Pork Ltd and the British Pig Executive.

Pigs in New Zealand are not castrated either surgically or immunologically and NZ Pork report that they produce good consistent quality pork. They are paid on back fat measurements at the P2 point as we are and they say they try to send pigs before they have boar taint. This does not mean, however, that there is no problem. People may not complain about it, they may just not buy pork again.

Uniformity is not identified as a particular problem even though not all pigs are weighed when they are sent for slaughter because producers believe adhering to the all-in-all-out principle is more important (Smith 2006).

In New Zealand they have the Welfare Act and there are codes of welfare that sit underneath that. In these codes there are various bits that are relevant to each species. Mostly they talk about the opportunity to display normal behaviour and having adequate food and water.

Quality and Uniformity

They have a set of Quality Standards but NZ Pork believes they are more about minimising quality defects than maximising quality. Hadleigh Smith (NZ Pork Board) didn't think that there was a problem with the quality of New Zealand pork and he also didn't think there was an issue with boar taint. It is interesting that they are trying to build links in to the Asian markets (particularly in Auckland where there is a large immigrant Asian population) when their industry is not castrating at all and the Asian market is more sensitive to boar taint than anyone else.

One of the abattoirs I visited said they do get comments about Pale Soft Exudative (PSE) meat.

Retailers

There are two main retailers. One is Progressive Enterprises that encompasses 5 brands and has 200 shops. The other one is Foodstuffs, which encompasses 4 brands and consists of 312 shops all of which are independent retailers.

There are also others: Mad Butcher which has 35 stores mostly in Auckland but they are starting to spread south, Export Meat Warehouse (30 stores), Aussie Butcher (4 stores in Auckland) and a discount retailer called Warehouse.

The retailers are satisfied; on same store sales are up 3.5% which is close to overall supermarket growth. The retailers report that pork sales are driven by price – sales go up when pork is on special offer and that they are not seasonal (Smith 2006).

In New Zealand they are only allowed to import fresh pork from Australia, any other imported pork has to be processed in some way into smallgoods. These processed products like bacon and ham are predominantly made from imported product.

Labelling

They do not have country of origin labelling but the NZ Pork Board actively encourages retailers to put labels on New Zealand produced pork products that indicate that they are home produced. The two logos they have are 100% NZ Pork and 100% NZ Trim Pork labels. The 100% New Zealand pork is just the ordinary NZ pork and the 100% New Zealand Trim Pork is pork that is trimmed of all visible fat and is only 4% fat. They seem to have the same problem that we have here with our Mark of Distinction – the use of the labels in some retailers is patchy.

The retail outlets are audited by NZ Pork to make sure that they are not putting the Trim pork and Heart tick on products that are too fat and do not meet the required standard.

Where are they going next?

NZ Pork Board is trying to:

- continue to build their retail market share through targeted campaigns and television
- build links with the Asian market in New Zealand (Auckland in particular because there is a high density there) and into Asian supermarkets
- raise the profile of pork to be the best barbecue meat
- assist and encourage the supply chain to respond to key demand drivers
- improve the Trim Pork market by working closely with retailers
- further increase the 100% New Zealand Pork brand awareness
- improve the awareness of the nutritional values of pork
- develop the country of origin differentiation further

PROMOTION

Consumer marketing

Consumer marketing by the NZ Pork Board is all levy funded but it is only small compared to beef and lamb. The promotion work they are doing is impressive given the small size of their industry.

They are running a TV campaign based on:

- Quick and easy meals
- Nutrition
- Value added
- Food in a minute

They also have a recipe club (www.pork.co.nz/recipe_club) on the Internet that people can join. It means NZ Pork can market to these committed users in a cost-effective way by offering its members special offers and monthly pork recipe ideas. It also means that they get instant feedback.

Quick and Easy

They are using a comedian called Mike King to present the adverts. He was described to me as "he's a Maori fella so he's a native"! What they meant was that he is someone who is obviously an ordinary New Zealander with no particularly culinary skills – a typical "bloke". The idea is that Mike King **is** New Zealand pork and the slogan is "Any Mike can make it" meaning if he can do it anyone can. These adverts are to give people high awareness of pork as a quick and easy meal, that it is **the** barbecue meat and to promote Mike's meals which are meals from other Mikes like Lemongrass Chops on the Barbecue and Quick and Easy Pork Mince.

Nutrition

The 100% NZ Trim Pork brand (pork that is trimmed of all visible fat and less than 4% fat) has the backing of the National Heart Foundation. It is part their campaign called Pick the Tick (www.pickthetick.org.nz) carries their logo.

The NZ Pork Board has a 60 second advert on TV featuring Marnie Oberer who is a nutritionist and marathon runner sponsored by the Heart Foundation. She is used because she is a credible presenter of the health benefits. They have found that they have to constantly remind people of the health benefits of this lean pork product or it gets forgotten.

Food in a Minute

Food in a minute is what we might call an advertorial if it were in print media. It is effectively an advert which is presented as a cookery show which is shown at 5.59pm every night on the television. It is made by a company called Watties (now Heinz Watties) that are makers of sauces and things. The programme is 60 seconds long and features Allyson Gofton who is a chef and is seen as a New Zealand icon. She shows the viewer how to cook a simple but attractive meal with the featured meat of the day. The industry bodies pay to have their meat featured, so New Zealand Pork Board pays to have pork or ham featured on the programme which is quite expensive but does seem

to be value for money. Food in a Minute recently celebrated its 10th anniversary and NZ Pork was delighted because they chose to use roast pork to celebrate. It is a very popular and effective show and also has a website (www.foodinaminute.co.nz) that has all the recipes on it and there are 64000 people who are members of it.

Summary

Currently pork is holding its own against the other proteins in a department that is under increasing pressure. New Zealand Pork Board's marketing strategy focuses on a number of areas with the aim of increasing 100% New Zealand pork sales and giving the margin back to the industry. The retailers agree that they have an opportunity to lift pork sales particularly in 100% NZ Trim Pork.

The Australian and New Zealand pig industries are interesting because they are not competing with imports in the way we are but they are competing directly with beef and lamb. It would be interesting to see how their pork industry would stand up if they were open to the same competitive pressures we are. From the point of view of industry representative bodies in terms of value for money and "bang for your buck" then they are in a great position because any money spent which results in any lift in consumption will directly impact the price their farmers achieve.

Hospitality Support

Another area that New Zealand Pork Board is working on is hospitality. Twenty five percent of pork goes in to this sector so they are working with them and also with schools.

The particular areas they are targeting are sponsorship, creativity, training and food safety.

Sponsorship

There is a WACS Global Chef Challenge being held in Auckland which is a worldwide competition that rotates round the globe. The New Zealand Pork Board sponsored a chef who cooked pork and they were very pleased because he won the regional competition which gave them excellent publicity.

Creativity and Training

NZ Pork is developing a book of cuts to be used for training and teaching purposes and also for sale. They also give four carcasses each year to the chefs' college to show them what to do with pork. This helps to encourage them to use pork in the future.

APPLE TENDER PORK

The NZ Pork Board has developed a branded, value-added product called Apple Tender Pork. This is a product that is moisture infused with apple juice. The product has been enhanced to increase the tenderness and consistency. It is promoted as being great on the barbecue and easy to cook. It also carries the Heart Foundation tick of approval which is important because it means that the consumer then doesn't think of it as being full of salt. They advertise it as being made to Mike's secret recipe which gives people confidence in the product.

Introducing Apple Tender

They carried out some attitudinal research that showed that people thought pork was nice but it was still seen as high in fat, being often dry and being easy to overcook. In this research people also specifically said it would be better if it were juicier.

They received the same comments with the Trim pork (some of which they promote with marinades) as the non-trim. When they did the same research people said that it was hard to cook unless it was marinated, it often dry and tough, the quality is inconsistent and it is still not on many restaurant menus.

Apple Tender pork was introduced in response to market needs. NZ Pork wanted it to be a moisture-enhanced product that is easy to cook, requires no preparation and addresses the fat and health concerns.

Apple Tender uses real New Zealand apple juice. They put some salt as a tenderiser in to the apple infused solution. They pump the pork to 11% - they say this is the minimum pump necessary. They use citric acid (potassium sorbate) as a preservative.

The meat browns well when it is cooked because the apple caramelises.

Supply of the Brand

NZ Pork chose 4 processors from around New Zealand to produce Apple Tender pork. They did it this way to encourage good coverage of the country and consistent supply. It also enables NZ Pork to control its production. They also introduced some processing parameters which are independently verified to ensure best practice. The processors are audited twice a year and they make sure they are using 100% New Zealand pork and apple juice and that they are using the correct recipe. This is to make sure that the quality of the product is maintained.

New Zealand Pork gets 50c per kilogram of any Apple Tender sold as a levy.

PRODUCTION

I visited Chris Trengrove's outdoor herd on the plains around Canterbury in South Island where the land is very flat and free draining. All the sows and piglets were outdoors and the piglets went inside when they were weaned. The sows were kept in groups in the field so each paddock is effectively like a pen. When they were weaned they were all in a smallish outdoor pen where there was a bank of three stalls for serving with a pen for the boar in front of them. The sows then went outside together. They are then brought in to farrow in huts with a farrrowing crate to prevent them lying on the piglets. While they were here they were let out twice a day for a drink and a walk round and then ten days after farrowing they are all moved in to a paddock with a hut per sow. The whole farm looked like a rural idyll because there was a complete absence of mud and everywhere was green. The pigs were weaned at 28 days and moved indoors to conventional indoor rearing and finishing unit.

I also visited a part new, part refurbished indoor unit in North Island that was just fabulous – I'd have put it in my pocket and taken it home if I could. They had converted existing weaner sheds into farrowing accommodation and were weaning a 7kg pig at 3 weeks. They kept their own gilt replacements and used 100% AI. They kept their sows loose housed in a trial eco-shelter for the last 12 weeks of pregnancy. The floor was deep sawdust with a concrete raised pad along one side where they were floor fed.

The weaner and finisher sheds were built 3 years ago. They weaned into two pens of 150 (one gilts and one boars) – this was one week's weanings and they stayed there until about 35 kg. For the first day they had some of the milk powder they were creep feeding them with in the farrowing house and then they moved on to pellets. Then they changed them on to wet feed, which they did over the course of one day and they are fed up to ten times per day so that there is only ever a little food in the trough. The frequency of feeding needs to be that high because when they are getting bigger the space at the trough is really tight. They have heaters in there for the first week and a computer controls all the heating and ventilation. At 35 kg they move to the finisher pens where they are kept in groups of 25.

There is virtually no disease – they have hospital pens for sick pigs but they tend to be the odd tail bitten pig or other physical injury and they do have the odd pig with meningitis. They de-stocked three years ago to eliminate enzootic pneumonia and they now only vaccinate against parvo and erysipelas.

All the feed is mixed automatically by a Big Dutchman and is essentially a combination of cereals and maize.

The pigs are not weighed before slaughter although they are installing a weigh scale in the loading race to weigh the odd batch. They sell them in complete pens by age and at the moment they are achieving 68kg deadweight but are trying to increase their growth rates to achieve 74kgs by the same age.

When they are going to be loaded on to the lorry they are run in to a pre-loading ramp passage that had gates at intervals along it. This means that the pens can be held individually pre-loading and also be loaded on the lorry in their stable groups. As they are living with the threat of PMWS infection they are using a lorry that only hauls their pigs and hauls cattle the rest of the time.

It was a really well thought out and fundamentally simple unit. My only worry would be what would happen if they were hit by PMWS because there was no spare space at all and the stocking densities were quite tight. The one thing in their favour was that every room was contained so no air spaces were shared and they were all-in-all-out and washed in between batches

PROCESSORS

In New Zealand the processors and abattoirs are referred to as wholesalers which is probably a much better description of what they do. Three of the four main wholesalers are farmer co-operatives or farmer based companies. They tend to either sell their products as carcases or as cartons of primals. These three wholesalers are NZ Pork's main customers and they act as a facilitator to sell pigs to the consumer.

ABATTOIR

Transport

In the abattoirs I visited the pigs were not transported in their stable groups unless the group contained a sufficient number that it was just a case of splitting them up.

Slapmarks

It is a legal requirement that all pigs receive a slapmark to identify the farm they came from. It should be applied on the farm before they leave but in some cases it was being applied as the pigs came off the lorry into lairage. The pigs were being slapmarked on the hams, which seems strange to me; I would have thought it would be better to slap on the shoulder as we do in the UK because it is a cheaper cut of meat. I was assured the consumer doesn't mind if they buy a ham with a slapmark in it!

Lairage

In the chill room of one abattoir there were carcasses with a lot of scratch marks which suggested there had been a lot of fighting in lairage. In the UK we would have been penalised for this but I was assured that the New Zealand consumer doesn't mind scratch marks either!

In the lairage at one abattoir electric goads were being used quite unnecessarily which really should be absolutely prohibited if you want to produce high quality pork. I saw a group of pigs that were all pen mates being unloaded from a lorry. They were all quiet and calm and they had to go through a funnel shaped race into a narrower one so there was a bottleneck. They were moving along perfectly nicely but slowly because of the bottle neck and the impatient person with the electric goad just couldn't resist giving them a prod. What had been the epitome of calm became squealing chaos.

The pigs in lairage had access to water but none of those I visited had misters which Danish research has shown to be as effective as group carbon dioxide stunning in the prevention of drip loss in the resulting meat. In one lairage the pigs were squirted with jets of cold water in the pens to clean them. I'm not sure that this was the best way of

doing it from a meat quality perspective because it was putting them under stress right at the time when they needed to be calm.

Abattoirs in the UK insist that pigs are not fed the night before slaughter to prevent contamination during evisceration but in one abattoir in New Zealand if the pigs were kept in lairage overnight I was told that they were fed before being killed the following morning.

Slaughter

The abattoirs I visited were all multi species abattoir killing pigs, sheep and cattle and sometimes deer. In the abattoirs I went to the pigs were electrically stunned and then stuck. There was no high voltage electrical stimulation being used on pigs but it is used in red meat as part of their quality system. As a result they have managed to reduce the shear force of beef and now all red meat sold is excellent quality even in the supermarkets. Nothing was particularly mechanised or robotised but all the abattoirs were well run and suffered from nothing more than trying to serve a small industry.

Chilling

The pigs are chilled for between 8 and 16 hours to -7°C.

Aging

Pork is not usually aged in New Zealand; it is usually eaten within a week of leaving the farm although one retailer is looking at selling pork that has been aged as primals for an extra 7 days.

ADDING VALUE

I visited a fantastic business in Christchurch which was an abattoir and a processor called Verkerks (www.verkerks.co.nz). They were killing pigs up to 65kg and selling 60% in to the fresh pork market and 40% went to their processing facility.

In the processing facility they were making every kind of value added product you can think of. Hundreds of different ranges - everything from half a dozen types of salami, chorizo, Bier sticks, dried and cured sausages with cheese in them - many of them were made out of trim and hard fat (they had buy in some of the fat). They also make shoulder bacon, middle bacon and small hams. In fact one of the hams came about because they had a glut of shoulders and needed to sell more, so they developed a small ham flavoured with honeydew and mustard which was then vacuum-packed. I was taken in to their seconds shop on site and we went round all the boxes of different products and there were massive of different lines. Everything was vacuum packed and labelled with the Verkerks brand and I saw them being sold all over the place in Christchurch. They just seemed to have that determination to do better all the time and improve what they do.

That was all pretty impressive in itself but they had also made a commitment to use only New Zealand pork in their Verkerks brand (remember – they could have used imported for processed meats if they wanted to) which just made the whole thing great. They had realised that without the pig producers they had no business so they needed to support

them and they were now getting concerned about the pig supply once PMWS really took hold. They also produced a “cheap” line that did not carry the Verkerks name in which they were going to continue to use some imported product because it gave them an option should there ever be a problem with New Zealand pork or if supplies were very tight but their core business would remain 100% New Zealand pork.

Canada

Background

Pork consumption in Canada is 25 or 26 kg per capita per year. This represents a small domestic market. The industry has been static from the 70s to the 90s. They used to be subsidised to take grain from the Western prairies to the east but this subsidy was removed in 93 / 94. Now the Canadian dollar is very strong it makes them uncompetitive with the US so expansion has ground to a very rapid halt.

The export of feeder pigs to Iowa is increasing and nearly one third of pigs go live to the US. This is because they can be fed for $10 less and also because they have realised the value of farm yard manure for arable cropping in Iowa so they are putting up finishing barns to make sure they have a good supply (Bernard Peet, conversation, 8 December 2006, Red Deer, Alberta, Canada).

The industry is really North American rather than a Canadian one and a US one because of the ease of crossing from one to the other. All the flow is from Canada to the US because the market is more favourable there. There is no pig reference price in Canada; they convert the Iowa/Minnesota price based on the lean meat equation of Canadian pigs and the relationship between the two currencies (Bernard Peet, conversation, 8 December 2006, Red Deer, Alberta, Canada).

Processors are also uncompetitive compared to the US and their prices have reduced by 20 – 30%. Some of the reason for this is processors in Canada do not operate double shifts so they are only putting half as many pigs through their plants which makes the time to re-coup the investment twice as long.

The Canadian market is very export dependent; they export to 80 countries but were mostly exporting to the US which used to account for 80% but has now reduced to 30%. The US is the biggest exporter of pork worldwide followed by Canada and then Denmark. Canada exports more pig meat to Japan than Denmark does (Ben Woolley, Sunterra Farms, Alberta, Canada).

Pigs sold in Canada are graded on carcass yield and producers can achieve as much as 14% extra in the price they are paid by achieving the right spec. They use a Desdron probe to measure back fat and loin muscle depth after the pig has been split in half along the spine so the grader can feel where the last rib is. They want 17 – 20mm of fat and a muscle depth of 70mm. They are taking the measurements between the 3rd and 4th last rib and 7cm from the mid-line.

They measure lean meat as a percentage of cold side weight rather than a percentage of the whole lot including head and kidney and so on. In Canada they are selling pigs at 100 – 105kg deadweight. The lean yield is calculated by taking the measurements for fat and muscle depth and applying an equation to it. This equation has been arrived at by doing many cut-outs in the past. This is where a pig is dissected muscle by muscle so that they can find out exactly what proportion of the total pig is lean meat. They are currently reassessing this equation because the genetics of the pig have changed over the years. They need to do a lot of cut outs to get a high degree of accuracy. For the

export market the quality of the pig depends on the size of the loin eye muscle (Robertson, Lacombe Research Station, 7 December 2006, Alberta, Canada).

The lines in the abattoirs run fast in Canada and as a result they end up with 10% of pigs not recorded because they have not been split properly and the grader cannot find where the mid line is (George Foxcroft, conversation, University of Alberta, Edmonton, Alberta, Canada).

Meat with soft lean tissue is meat that has normal pH and normal colour but is soft and floppy. It is not desirable to have meat like this particularly in Japan. It is necessary to find a way to measure this. There can be a situation where the pigs are too lean. For pigs that only have a back fat depth of 12mm they find they have a problem with soft meat and in separating the fat from the lean. (Robertson, Lacombe Research Station, 7 December 2006, Alberta, Canada)

Although the processors become more efficient as the weight of the pigs they receive increases there is a point at which it will not be cost effective to the farmer to produce heavier pigs because the cost of feed just to maintain weight will be too high (Robertson, Lacombe Research Station, 7 December 2006, Alberta, Canada).

In Canada 70% of feed production is HACCP registered. They are allowed to put Meat and Bone Meal in any feed except ruminant feed. They can use pure porcine or equine in ruminant feeds but apart from that there is a total mammalian ban but they can also use poultry, fish and feather meal. The specific risk material will be stripped out after 12 July 2007 (Kathleen Sullivan, ANAC, 14 December 2006, Ottawa, Canada).

Marketing

Until 1996 they had single desk selling in Alberta through the Provincial Pork Board (Alberta Pork) but now they are all marketed through the Western Hog Exchange. Bernard Peet believes (conversation, 8 December 2006, Red Deer, Alberta, Canada) the Western Hog Exchange has reduced the amount of dialogue between the processor and the producer, that they market pigs badly ("they just get rid of them") and they don't add any value.

Olymel kills the most pigs in Alberta (60%) and 60 – 70% of them are marketed to them by the Western Hog Exchange with Olymel taking the rest directly from bigger producers. A further half a million pigs go through the Maple Leaf plant at Lethbridge and then there are a handful of smaller processors. Some people ship pigs as far as Brandon, Manitoba – around 1500 miles. (Bernard Peet, conversation, 8 December 2006, Red Deer, Alberta, Canada).

Rocky Mountain Pork

Rocky Mountain Pork is a group of independent producers which, I believe, was set up to be a branded product but hasn't quite worked that way. The producer pays $1.25 / hog to be part of the group and the processor (Olymel) pays $1 per hog (if they bought them through the Western Hog Exchange instead they would still have to pay $1 / hog). The theory is that Olymel are paying Rocky Mountain Pork to get its producers to produce pigs of the right specification. Rocky Mountain Pork supply 10% of Olymel's throughput.

Rocky Mountain Pork provides a herd recording system (Pig Win) for up to 400 sows free of charge and then if the producer has more sows they pay the rest. All the producers in Rocky Mountain Pork have Danbred pigs.

They get paid on a fixed or variable window based on the calculated feed price which is 80% Chicago Board of Trade soya and 20% Winnipeg barley. The pricing is meant to be neutral and reflects feed price and is designed so that the price never goes below the cost of production. You do get a time when the feed price is high which puts the price paid to Rocky Mountain Pork producers up while the price paid to the rest of producers is low. This happened in December 2006 and it makes the processor disinclined to continue with the contract because they are suffering as well.

Peet feels that Olymel don't understand value added and they don't want to renew the contract with Rocky Mountain Pork. As a result they may decide to kill the pigs in Canada (at Trochu), ship primals to Oregon and sell it down the West coast of America as a branded product (Bernard Peet, conversation, 8 December 2006, Red Deer, Alberta, Canada).

Blue Diamond Pork

I visited a farm in Alberta called Blue Diamond Pork. This was a fully slatted fully indoor temp controlled fan ventilated shower in shower out pig unit with all the sows in stalls. All the pigs are automatically wet fed and the feed is all mixed on farm. The result is a pig unit which is very labour extensive. There are 3 people working there one of which is ¾ time at most and that is three quarters of a 40-hour week and it takes one person two hours per day at the weekends. The staff are able to spend time concentrating on the pigs because there are very few mundane tasks like cleaning out as there are on a straw-based unit.

They have a very different attitude to that which we have in the UK, once they have invested in a modern unit like this they do not see it as job done. Having put it up they know that they expect to replace units every 15 years or so to enable them to take advantage of improvements in technology and possibly other design issues. It is not an insignificant investment to build a unit like this but they know how long the pay off time is, what the cost is per pig produced and that the investment is worthwhile because it increases their competitiveness and they have a very commendable approach to their business.

Sunterra Farms

I was delighted to have the opportunity to visit Ben Woolley and the Sunterra Farms enterprise. Sunterra Farms is a family-run business that produces pigs (in Canada and the US) as well as cattle and sheep, has its own abattoirs (this is in addition to sending pigs to other commercial abattoirs), sells meat in Canada and the US as well as exporting some to Japan and has a few retail outlets.

Sunterra Farms found that it was impossible to compete with larger scale producers so they wanted to target the high end of the market to ensure they would never have to compete with them and as a result decided to develop meat lines based on quality. In 1998 they had 250 employees and now they have over 1000. They then bought an

abattoir and they now have 13000 sows. The majority of their pigs go to the US to be finished but some stay in Canada and go through their tiny processing plant. It is more profitable for them to send the pigs to the US than it is to finish them in Canada.

Sunterra Farms are achieving the highest price in North America for the pigs they export to Japan. The pigs for this market are killed in one of their four plants. This plant kills 2500 pigs per week and 75% of the throughput of this plant goes to Japan. To be able to achieve this price they are producing pork to very high standards – using specific genetics, full traceability, carbon dioxide stunned, the pigs cut the way the Japanese customer wants them, hung longer to achieve a darker meat colour, the animals are skinned and they are antibiotic free for the last 100 days. Those animals that fall outside the weight range for this market go to Mexico. They sell to Japan in whole primals and the butchers butcher it when it gets there because if it is cut in Canada it decreases the shelf life.

In one of their other abattoirs they are also killing sheep (200 per week) and veal (500 – 600lbs, a slaughter animal killed a bit younger rather than French veal), buffalo, bison, elk and reindeer. They have a multi-purpose kill cage and then a hydraulic lift and are targeting the niche market - they have even killed caribou there but they are generally killed further north and the carcasses are brought down. They will cut meat to whatever size anyone wants whether it is primals or smaller cuts.

They also have Ranchers Plant in Calgary which is a beef plant that produces very high quality and high value beef. They have full traceability and can take every piece of meat from here back to the cow/calf producer that produced it. They also have 5000 acres of grass and pasture of their own that is used to produce the cattle for Ranchers beef. They kill 800 head per day at this plant and it is all marketed very successfully under the Ranchers Beef brand.

Sunterra have succeeded in being able to produce for niche markets. If the Japanese market wants a specific cross and cut of meat they are able to produce it for them. Each animal is given a specific number that stays with it throughout the processing plant. The barcode on the parts of that pig relate to its number and enables it to be identified as it goes down the line. When the piece of meat reaches the person on the line who is going to cut it the computer screen tells him how to cut it and how much it should weigh. He then receives instant feedback on how he has performed. Sunterra believe that Ranchers Beef will get approval from the EC and then they will be able to export branded product to the Europe Union.

Their final processing plant is Great Lakes Meats in Ontario which they are in partnership with the biggest cull sow buyer in North America. They will only kill things they know they can make money out of. They won't get in to the commodity market and would rather cut the kill than lose money out of it.

This all shows that they have looked at each of the species that they are working with and have found what adds value to them and have set up their plants and farms accordingly. They are not interested in doing things that are not profitable.

<u>Stores</u>

Sunterra Farms have 3 full service grocery stores that target the high end of the market in very affluent areas of Calgary. In one of these areas Sunterra was asked to put a store there when the mall was built but they only agreed to it if they could be partners in the whole mall because they wanted to be able to choose their neighbours so that the whole venture attracted the right kind of customers. All the beef, lamb and pork in these stores is produced by Sunterra Farms and they have a chef in-store who will prepare the meat for you and tell you how to cook it.

They have designed it as a combination of a grocery store type of operation and a delicatessen. People go in to the store to buy their usual groceries like milk and washing powder and while they are there they buy more of the value added products as well. Sunterra have priced their products so that for an average basket of shopping they are no more expensive than the supermarkets but they make money from the value added products. They have their own on-site bakery which bakes overnight for all the Sunterra stores, they also make and sell a variety of sweet cakes and pastries. They also sell smallgoods like sliced hams and smoked sausages which are made for them by another company and branded Sunterra. They also sell fresh meat products which have had value added to them by adding marinades.

Sunterra also have 5 downtown stores that are targeting people who work in the downtown (business) areas. In the morning the chillers will be filled with items that people can eat for breakfast as well as pastries, and then everything is changed for the lunchtime rush when they serve around 1800 lunches. In the afternoon the chillers are filled with things that people can take home and cook for dinner. It is an extremely well thought out and slick operation and has been put together very cleverly to make the optimum use of the space. The food served at lunchtime is first class and the cooked options can be roasts or other traditional hot main courses and then big pots of something like chilli or curry or stew. The hot cooked food they serve is an important part of the business because it means that they can make use of any meat that had been for sale as a raw product in one of their stores that is about to run out of shelf life. By using them to make the hot meals they are further adding value to a product that would otherwise have been thrown away.

The downtown store I visited was fabulous and I tried the main meal they had on that day which was marinated ham with a garlic sauce. It was a very good eating experience (!) but it was really quite fatty - not so much intra-muscular fat but inter-muscular fat.

They have also started a joint venture with a Starbucks store in Calgary where instead of selling the usual Starbucks food they are selling high quality Sunterra salads and sandwiches and so on. This has been a very successful venture and now it is the biggest grossing Starbucks store in Canada. The Sunterra products have increased the average consumer spend in the store.

This is the public face of Sunterra which is a $300 million company – the retail element of it is quite a small part of their turnover but it is impressive none-the-less. They now have such a reputation for their downtown operations that they are asked if they can do the food provision in new office blocks.

Ben Woolley said that a retail outlet should be “competitively priced and beautifully presented”. That means exceptional value, competitive prices and excellent service. He

says that what they sell is not cheap but it is exactly what the customer wants and is also good value.

They are in the process of building a 15000 head sheep lot because they don't have a consistent supply of lamb into their abattoir because most sheep producers just do it as a hobby.

Genetics

They have no genetic cost because they produce their own stock. They are selecting stock for meat quality traits in different lines. One of the lines they are selecting primarily on growth rates and other lines are being selected for muscle and meat quality. They also have synthetic dam and boar lines that have some Duroc for meat quality.

Many of these lines originated as PIC lines but there are differences between them now because Sunterra have developed them to produce better quality meat.

They also have a Berkshire line to enhance the Japanese product in Japan. They also sell purebred Berkshire product in Japan. They have a further line with some Berkshire in it that is bred for meat quality and to have good maternal instincts. The progeny from these are cheaper to produce than the pure bred.

They have also developed a white pig with good meat quality and lots of intra-muscular fat which has been selected for 30 years on growth rate. It will produce 21 pigs per sow per year which is not as good as a commercial breed but it will grow at 700 – 800 g per day.

Ben Woolley suggests that in the UK we have been selecting for everything that is bad about meat quality – the meat is very lean and we are selling pigs that are very light in weight compared to Canada which means they are low in intra-muscular fat. Berkshire meat cooks well because it has high intra-muscular fat.

Ben doesn't think boar taint is an issue in the UK because we kill the pigs at a relatively young age. He knows of one company that is working on an in-feed product that will take away boar taint. All pigs in Canada are castrated surgically because they are selling them at a much higher weight. They aim to sell pigs at 123kg liveweight. In the US they can go as high as 135kg without getting a penalty which means that the chops are very big in the US and the streaky bacon is very fat. The weight in the US is driven by slaughter efficiency as well as by the market. This is because it takes no more labour to cut at 135kg pig than it does a 100kg pig. It is all driven by a cheap food policy.

Temple Grandin from Colarado State University does a lot of work on reducing stress in livestock and she has changed the way abattoirs are run so there is no use of electric goads and the pigs go in to lairage the same day as they are killed. Pigs are not loaded in to the lorry in stable groups – the pens they have come from are groups of about 20 and they may take 3 pigs from each pen. It takes around 2 hours to get to the abattoir and there is no fighting.

Olymel accepts pigs that have been fed meat and bonemeal. Sunterra foods don't feed any animal by-products at all and that includes no plasma and no fish meal. They use whey for baby pigs.

Two percent of the total of the Sunterra Farms production goes through their slaughter plant and through the retail outlets but most of their production is sold as live pigs in the US - they have 100 000 pig places in North West Iowa.

Maple Leaf Foods

I spent my final week in Ottawa and Toronto and met Don Davidson and Bill Ballantyne from Maple Leaf Foods.

Maple Leaf has Signature Pork contracts for independent producers who meet their supply specification. The contracts are for between one and five years but are mostly a one year contract. They are paid on a formula based on the US price.

Maple Leaf process 7.2 million pigs and the bulk of those bought are from Signature Pork contracts which meet the criteria for desired weight and attributes. Of those pigs 90% are on contract. Maple Leaf also has some form of ownership of 135000 sows and currently has 8 processing plants. This means that they actually own 25% of the system. Maple Leaf is about to go through a major restructuring, which will result in them owning 4.5 million pigs and one processing plant and they will then own the whole chain. This will mean that there is no longer an opportunity for independent pig producers to supply Maple Leaf. I think they are trying to homogenise production and finish up with exactly the right product produced to exactly the right specification.

In Eastern Canada pig diets are corn (maize) based with soya as the protein but in western Canada the diets are mainly barley based. The fat in barley fed pigs tends to be whiter while feeding pigs maize tends to make the fat yellow. Maple Leaf have done work on improving sow feed quality to improve marbling in the progeny.

In order for Maple Leaf to produce the high quality meat they are looking for the pigs need to be of preferred genetics. They look at the pork that is coming from the animals and if it is not good enough then they change the genetics. They are finding that poor quality is becoming less and less of a problem and that pigs are becoming more and more uniform. The pigs they are using in Canada contain a lot of Duroc particularly in the West because of the Japanese market. In Ontario and the east it tends to be a white breed with a Pietran boar. Maple Leaf has found that for further processing ham and for moisture infusing then using the Pietran is better.

Maple Leaf believes that there is a solid advantage to Paylean for both the producer and the processor in terms of yield. The slight disadvantage of it is that there is less marbling but there is less back fat on barrows (castrated boars) and the water binding of the meat is improved. Paylean also makes the pigs more susceptible to stress so more time has to be taken in loading and unloading them because more care must be taken. It is possible that if they are handled wrongly that there is an increase in the incidence of PSE because of its link to stress.

In one of the Maple Leaf plants the stunner is a carbon dioxide tunnel through which pigs are carried on a conveyor. They also have an automatic electric stunner where pigs go down a conveyor supported by belts then their heads are held and the paddles come down to deliver the electric charge. Don Davidson reported that they had found that there were fewer issues with blood splash in the meat when it was done this way rather

than manually. He also believed that there is no difference in meat quality between a good electric stun and carbon dioxide. The new way of stunning electrically is more reliable and efficient but group stunning with carbon dioxide requires less labour and so is more efficient.

Maple Leaf is producing value added boneless products in fresh pork, marinated pork as well as pre-cooked options. They produce moisture infused pork for a number of retailers and the maximum pump level they use in Canada is 7% which guarantees that it cooks well.

Another of their value-added ranges is chilled pork exported to Japan. They are hot skinning pigs and then slow chilling for up to 18 hours make the meat darker. They have found that blast chilling is quicker but it makes the meat lighter in colour. This darker meat colour with a slightly higher pH is also contributed to by the genetics and processing as well as producing a slightly more mature pig. Pigs from different farms can be worth $20 more than the average if their yield and quality are suitable for the Japanese market.

Any aging is done in vacuum packs rather than as a whole carcass. This is because all the biochemical changes happen in the first few days so the carcass quality is not improved by longer hanging. The only time this may be different is if it is hung in dry conditions for 12 to 14 days but only because the carcase is losing moisture (Davidson & Ballantyne, Maple Leaf Foods). The pork is sent to Japan in Cryovac packs and it takes 21 days to get there; when it arrives it will have a further shelf life of 45 days. As aging occurs in vacuum packs then it may be that there is some aging that continues over this time which may contribute to the quality of the product.

Boar Taint and Castration

Boar taint is an unpleasant and undesirable taste in meat from boar pigs caused by naturally-occurring male hormones. It has been variously described as like urine, perspiration or onions and so on and is generally detected when the meat is being cooked or when the hot meat is eaten. Boar taint is a significant worldwide issue and castration is a debate that continues in some quarters and will probably return when those countries that still castrate surgically face up to the welfare implications of it.

Boar taint is caused by a combination of androstenone which is a male sex hormone produced by the testes and skatole, a metabolite of the amino acid tryptophan which is produced in the hind gut by the bacteria that live in the intestines. Androstenone is only found in boars and is a hormone produced by the body of a sexually mature pig. Skatole can be found in castrates and gilts as well, particularly if they are kept in dirty conditions but at lower levels (Boar Taint: A Time Bomb or a Fallacy, 1998). When both these compounds are found in a boar they have a synergistic effect and make boar taint worse (Morel 2006).

Genetics also play a part with Large White having the lowest risk of boar taint while Duroc crosses carry the highest risk (Lacombe Research Station, 7 December 2006, Alberta, Canada).

There seem to be as many opinions about the existence or otherwise of a boar taint problem, as there are people to debate it. One thing that has become clear on my travels is that it is definitely more of a problem in Asian countries because they are highly sensitive to boar taint and as such the Singaporean market, which Australia supplies, will only accept gilts and castrates. This difference in sensitivity between nationalities may account for some of the inconsistencies surrounding the presence or not of a boar taint problem. It seemed to be that those countries that export to Asia have more concerns about boar taint than those that do not.

Morel, Pearson and Johnson (1997) carried out a study on the percentage of pigs found with boar taint. They tested fast growing heavy and light pigs so they had a good spread of age and weight because of the common perception in New Zealand that they have no boar taint problem because they sell the pigs young. They found that it is not the case that if they are sold at below 24 weeks of age there is no taint. Morel (2006) said that this was confirmed by a Norwegian study three years ago that the only way to guarantee no boar taint is to slaughter boars at a maximum of 40 kg. They also found that 31% of boars had a skatole level above the EC threshold of 0.2ppm and an androstenone level above the EU threshold of 1ppm which suggests that they would have a significant boar taint because of the two compounds working together. Morel (2006) believes that two out of three male pigs have a boar taint problem.

Other studies from many Australian and New Zealand farms have consistently shown that 20% of boars, at current average slaughter weights (approximately 90kg live weight) are highly tainted and that a further 20 – 30% are moderately tainted. It is also reported that approximately 25% of all consumers are highly sensitive to boar taint with another 50% being moderately sensitive to it (Boar Taint: A Time Bomb or a Fallacy?, 1998).

From these figures we can calculate that:
15% of boar meat will be highly tainted **and** eaten by a person either highly or moderately sensitive to taint.
7½% will be moderately tainted **and** eaten be a person who is highly sensitive.
15% will be moderately tainted **and** eaten by a person who is moderately sensitive.
62½% will be either not tainted or eaten by a person who is not sensitive.

We can conclude that there is likely to be a problem, in Australia and New Zealand, with 22½% of boar meat and no problem at all with 62½% of boar meat. This equates to a problem with 11¼ % and no problem with 81¼ % of total production (gilts and boars).

Morel (2006) said "There is a problem [in New Zealand] because we are not castrating and a problem in Europe because they are castrating" meaning that if you do castrate there is a welfare problem and if you don't there is an eating quality problem.

Hendriks and King (2002) agree there are differences in the detection of boar taint but report that 50% of men and 90% of women can detect androstenone, while all people can detect skatole. Hendriks and King (2002) do go on to say that results from sensory evaluations of boar taint by laboratory panels are inconsistent due to differences in methodology, sample preparation and so on. They also report that consumer surveys have shown that there are major differences among countries in the detection of boar taint and the level of dissatisfaction with the odour of pork from entire males. This further supports the importance of conducting market research in the country you wish to supply.

Consumer surveys have been found to detect boar taint less often than trained laboratory panels. This may be because when pork is eaten as part of a meal the boar taint is masked (Malmfors et al (1989) (in Hendriks and King (2002)). British and Irish studies consistently report a low level of reported boar taint. In some cases neither consumer surveys nor sensory panels discriminated between meat from entire males, castrates or gilts (Various studies reported in Hendriks and King (2002)). Babol and Squires (1995) (in Hendriks and King (2002)) attributed these results to the low slaughter weight of pigs in the UK. Research from areas excluding Britain and Ireland showed that 15 – 35% of consumers detected off-odours in entire males and 3 – 10% detected them in gilts and castrates (Malmfors and Lundstrom (1983) in Hendriks and King (2002)). Slaughter weights in the UK are higher than those in New Zealand where consumers seem to prefer a pork chop about the same size as a lamb chop. So it might be more likely that in the UK we as not as sensitive to boar taint and this is part of the geographical variation in detection that has been seen or else we have not been castrating for a long enough period of time that people have become more used to it or they have been desensitised to it. A large-scale consumer survey of boar taint conducted in seven European countries found that the level of skatole accounts for a higher proportion of consumer dissatisfaction with the odour from pork from entire males than the level of androstenone (Anonymous 1998 (in Hendriks and King (2002)). Bonneau (1998) (in Hendriks and King (2002) found that in relation to off-flavour androstenone and skatole were found to be additive not synergistic. This study also found that:

- Women tend to be more critical of boar taint
- Differences exist in the detection of boar taint among countries
- Level of dissatisfaction with boar taint among countries

Reducing the levels of either or both skatole and androstenone in carcasses would greatly reduce the disparity in consumer satisfaction with pork from entire males and females.

Hendriks and King (2002) say that in research funded by NZ Pork it was shown that the fat levels of male pigs reared in New Zealand contain high levels of androstenone and skatole which means they will have high levels of boar taint. They also suggest that it is clear from the research that boar taint is present in New Zealand entire male pig carcasses killed between 50 and 80kg when identified by measurements of critical levels of androstenone and skatole in the fat and that the New Zealand consumer also has some degree of awareness of boar taint.

There are ways to detect boar taint in the abattoir: a soldering iron, microwave test, Elisa test or an electronic nose. The Swiss have developed an electronic nose that works but it is quite big. If this could be developed into a practical working machine then it could be used in conjunction with Improvac (Morel 2006).

There are ways that boar taint can be managed (from Hendriks and King 2002) surgical castration, immuno-castration (Improvac), cleanliness to minimise skatole levels and dietary manipulation (inulin, tryptophan).

Factors Affecting Androstenone and Skatole Levels

As well as gender, Hendriks and King (2002) report that there are other major factors that affect the levels of androstenone and skatole:

Genotype - Androstenone levels in fat vary between genotypes and can therefore be selected for genetically (Hendriks and King 2002).

Age and Liveweight – the level of androstenone found in the fat of pigs increases with age and liveweight (Andersen 1976, Willeke et al 1980 both in Hendriks and King 2002) the reason for this is the sexual maturity that accompanies the increase in age and weight. Walstra et al (1999) (in Hendriks and King 2002) found that both androstenone and skatole increase with increasing carcase weights.

Environment – season, social interaction and housing are the three environmental factors that affect the levels of androstenone and skatole (Hendriks and King 2002).

- Season – some studies have shown that an artificial lighting regime simulating summer decreased the level of androstenone compared to one which simulated winter (Claus et al (1994), Andersson et al (1998a) both in Hendriks and King (2002)). Although sensory evaluation by a tasting panel failed to distinguish between the two regimes suggesting that although season affects the androstenone levels it does not cause differences in the odour emitted from the meat (Walstra et al (1999) in Hendriks and King (2002)). It has been observed that skatole concentration is almost twice as high in summer as in winter (Hansen et al (1994), Walstra et al (1999) both in Hendriks and King (2002)). Hansen et al (1994) (in Hendriks and King 2002) thought this was because the high temperatures caused an increase in the level of skatole released from the faecal material in to the air which was then being absorbed in to the lungs and deposited in the adipose tissue.

- Social Interaction – Androstenone is a sex hormone and is stored in the body fat and in the salivary glands. It is released from the salivary glands during courtship (Hendriks and King (2002)). It has been shown that dominant males suppress the sexual development, and subsequently the levels of androstenone, in other males in a group (Claus et al (1994) in Hendriks and King (2002)). Conversely, however, Giersing et al (2000) found that pigs with high levels of androstenone had a stimulatory effect on the levels of androstenone on other males. There is clearly some confusion here and we have to ask if it is possible to manage boars differently to affect any boar taint that is caused by social interaction.
- Housing – It has been found that a high degree of fouling pens with faeces and urine significantly increases the deposition of skatole in subcutaneous fat (Hansen et al (1994), Hansen et al (1995) both in Hendriks and King (2002)). Hansen et al (1994) (in Hendriks and King (2002)) hypothesise that this is because skatole is absorbed from the faeces through the skin into the subcutaneous fat and through the blood in to the lungs where it can accumulate in the fat deposits. This is why in order to minimise the incidence and level of boar taint it is important to keep the pens clean and ensure the pigs are clean at the time of delivery.

Nutrition – Skatole levels in the fat may be affected by nutrition and in particular the feeding regime along with the levels of indigestible fibre and the level and type of protein in the ration.

- Indigestible Fibre - The level of dietary fibre may be relevant because it provides a source of readily fermentable energy for the bacteria in the hind-gut. This could increase fermentation and therefore bacterial population which would provide more protein of bacterial origin. As bacterial protein contains typtophan an increase in the population would increase the level of tryptophan available for hind-gut fermentation. This would produce more skatole which can then be absorbed by the large intestine (Hendriks and King 2002). These effects have been shown by Lundstrom et al (1998) (in Hendriks and King (2002)) whereas Oeckel et al (1998) (in Hendriks and King 2002) showed no effect of high fibre diets on skatole. Hawe et al (in Hendriks and King (2002)) managed to show that when the fibre was sugar beet pulp the skatole levels were no affected but Jensen et al (1995) (in Hendriks and King 2002) managed to show that sugar beet pulp reduced the levels.
- The effect of dietary protein on skatole levels varies depending on the digestibility of the protein which in turn depends on the protein source used. It has been shown that more digestible protein reduces the amount of dietary protein, and therefore tryptophan, entering the hind-gut minimising its fermentation in to skatole (Jensen et al (1995) in Hendriks et al (2002)). However, Claus et al (1994) (in Hendriks et al (2002)) found that altering the amount of tryptophan in the diets has little effect on the level of skatole in the fat. Hendriks and King (2002) believe that the usual good practice of using highly digestible protein sources and well-balanced diets is a sensible option that also reduces the effect of protein nutrition on the incidence of boar taint.
- Feeding regime may also have an effect on skatole levels. Patterson et al (1990) (in Hendriks and King (2002)) found that in pigs fed ad libitum the average skatole levels were consistently higher compared to restrict-fed pigs and male

ones in particular. Hendriks and King (2002) suggest that this may be associated with restrict-fed pigs having more efficient protein digestion.

Methods for reducing the incidence of boar taint (Hendriks and King 2002)

- Nutrition
  - Rations containing highly digestible proteins
  - Restricted feeding
- Slaughter weight
  - Lower slaughter weights
- Effluent removal
  - Clean accommodation – particularly for finishing pigs
- Environmental factors
  - Maintain thermo-neutral temperatures for grower and finishers
- Castration

Hendriks and King (2002) go onto to remind the reader that surgical castration has the disadvantages of reduced growth and production performance and has potential animal welfare concerns. It has been noted (Martin (2000) in Hendriks and King (2002)) that surgical castration could reduce the profitability of Australian farms by between 6 and 77% depending on the price schedule received. This may or may not still be the case.

Improvac – Immuno-castration

If you accept that non-castration of boar pigs causes a problem with boar taint in the meat produced then you have to decide what the next move is. If it is decided that surgical castration is not concordant with good animal welfare or the perception of it then we have to look at other options.

One of these options is immuno-castration and the product used is Improvac. It was produced in Australia by a company called CSL and has subsequently been sold to Pfizer.

How does it work?

Immuno-castration is a way of preventing the causes of boar taint in meat by inhibiting sexual development, reducing plasma gonadotrophin and testosterone and reducing the accumulation of these substances in carcase fat by vaccinating against gonatotrophin releasing factor (GnRF) (Dunshea and McCauley, 2001). Improvac is a vaccine which contains a modified form of GnRF in a low reactogenic adjuvant system (Dunshea and McCauley, 2001). The vaccine targets the production of androstenone. It works by shutting down the production of testosterone, which changes pigs behaviour but also drops the levels of ancillary compounds like androstenone, which is a contributor to boar taint. The other contributor to boar taint is skatole and the vaccine has no effect on the skatole levels but there are ways of ameliorating its effects. Kim Nairn (conversation, Portec, 6 November 2006, Perth, WA) quoted the work done in the UK that has shown that skatole is not a problem in boars over 100kg because of faster growth rates.

Use on Farm

Improvac is marketed to producers in Australia as a herd management tool that stops the growth rate of entire males reaching a plateau. The pigs need two doses; the first is given at a move (usually at 10 – 12 weeks when moved from the weaner to the grower

facility) and then a second one 4 weeks before they are sold (the window is 3 – 5 weeks).

For anyone who is concerned about operator self-injection, the effect of Improvac is temporary and I am assured that the person who injected himself accidentally made a full recovery although his wife had some peace and quiet for a while! CSL have designed a special gas-powered injector which has a retractable safety shroud around the needle to prevent self-injection and the vaccine will only be injected when the safety shroud has been depressed to the full distance (Kim Nairn, conversation, Portec, 6 November 006, Perth, WA).

Once the second dose of the vaccine has been given it is necessary to adjust the nutritional programme because the castrates have reduced growth efficiency because all they want to do is eat and sleep. A pen of Improvac treated pigs is very serene sight – they just lay about contentedly! The ration they are fed post-Improvac is a gilt ration because they tend to get fat in a similar way to gilts. CSL reported in their leaflet Improvac: Boar Taint Vaccine for Male Pigs (1998) that in some studies the carcases produced were 2 – 6 kg heavier with an increased back fat of 0.5 – 2.0mm and that compared to intact boars there is no effect on feed conversion efficiency but it is much better than in surgically castrated boars.

Dunshea and McCauley (2001) report that treatment with porcine somatotrophin (pST) ameliorates the effect of the increase in fat deposition which is one of the consequences of using Improvac and they also report that there appear to be some synergies between the two technologies.

Claimed Benefits

Some attractive claims are made by CSL in the leaflet Improvac: Boar Taint Vaccine for Male Pigs (1998) that the “producer and the processor can benefit from the flexibility of being able to increase slaughter weight and thus improve profitability without increasing the risk of taint”, “without the worry of boar taint the more energy efficient male pigs can be targeted at the heavier markets, leaving the less efficient female pigs for lighter markets” and also “by reducing sexual and aggressive behaviour the pig is allowed to grow closer to its genetic potential ……. [which] can result in better profitability for both producer and processor”.

Dunshea and McCauley (2001), in their research in to immuno-castration, report that Improvac decreases gonadal steroids and appears to have some additional effects on sexual, aggressive and feeding activities with the resultant improvements in growth performance.

Does it Add Value or Improve Profitability?

In Australia they report that Improvac is a good product that works well (Kim Nairn, conversation, Portec, 6 November 006, Perth, WA), although it is quite expensive at $3.20 per pig. The producers get a slight bonus for immuno-castrated pigs but the increased performance, the cheaper ration that can be fed and the reduction in fighting and riding which reduces skin blemishes and condemned weights in the abattoir reportedly pays for the vaccine anyway. CSL report that the decreases in aggression, fighting and stress have shown to result in improved meat quality because there is a

reduction in “dry-firm-dark” (DFD) meat and less bruising and blood splash which leads to fewer losses to the producer and processor and better quality to the consumer and a better industry image (Improvac: Boar Taint Vaccine for Male Pigs, 1998). Bruce Mullan (Medina Research Station, WA) reported that there are fewer blemishes found on the skin of animals that have been vaccinated with Improvac.

Identification of Immuno-castrated pigs

The testes of the pigs are smaller in immuno-castrated boars but they do not disappear altogether and Pfizer have produced a template that is placed over the testes and if they don’t fit through it they are rejected as a castrate and are sold as an entire. There was some suggestion that the vaccine was not 100% effective but Michael Danby (Production Manager – Pigs, Pfizer Australia) agreed that it was just that the strike rate of the operator was less then 100% and that some pigs were missed.

When the vaccinated pigs are sent to the abattoir they are marked with an extra B with their slapmark to indicate that they are castrated boars. The 5-digit slapmark is linked to the farm of origin (Kim Nairn, conversation, Portec, 6 November 006, Perth, WA).

Consumer Issues

There are various issues that surround the use of a product such as Improvac in the minds of the consumer. These seem not to have been an issue in Western Australia but enthusiasm for Improvac is not uniformly high. Terry Brown (APL, conversation, 14 November 2006, Canberra, Australia) is not keen on immuno-castration because he believes there is too much of a risk from a consumer perception point of view. They did a focus group on it and they report that the reaction was “violently against it” and points out that the advantages are negated if you can’t sell the product.

The Singaporeans will not accept immuno-castrated boars (Kim Nairn, conversation, Portec, 6 November 006, Perth, WA). The reasons for this seem unclear – I was told that it was because they could still see the testes and they think it is not 100% effective against boar taint but I was subsequently told other reasons.

Perth Pork Company (PPC) export pigs to Singapore and they have to be either gilts or surgical castrates because of the taint. They report that their customers are getting used to the idea of immuno-castration. Currently the producer gets paid a slight premium for surgical castrates.

CSL addresses some of the issues in the leaflet Improvac: Boar Taint Vaccine for Male Pigs (1998). They explain that the mode of action is immunological and that “this vaccine is not a “hormone”, nor do any of the constituents have any hormonal activity”. They describe the mode of action as stimulating the pig’s immune system to produce specific antibodies against GnRF. These natural antibodies inhibit GnRF activity, thus temporarily inhibiting testes function. They tell us that Improvac gives the consumer improved eating quality by decreasing taint and producing a more consistent, higher quality product. They also tell us that Improvac provides a “welfare-friendly alternative [to surgical castration] that allows boars of any weight to be marketed without fear of boar taint”. In fact this leaflet goes as far as marketing Improvac as a product that improves eating quality.

Morel (2006) suggested there were fewer issues with Improvac in Australia because town and country were so far away from each other and maybe there weren't so many "greenies"! He thought that in a country like New Zealand there would be more difficulty in persuading people that its use was acceptable.

Discussion

As I mentioned earlier, Australian and New Zealand studies have shown that taint is probably only a problem in around 11¼ % of all pigs produced. Studies have shown that boar taint is consistently not detected in British and Irish studies whether they use consumers or a professional taste panel (Hendriks and King 2002). Finally, a large-scale European study (Anonymous (1998) in Hendriks and King (2002) concluded that skatole accounts for more of the dissatisfaction than the androstenone.

I believe this shows that castration would not produce a notable improvement in the eating quality of meat from pigs produced in the UK when they are destined for domestic markets. The direct result of not castrating is that we produce products that have a higher ethical quality to those that are imported.

If an opportunity arose for some producers to export pig meat to Asia then this may have to be reviewed on a case by case basis based on market research in the destination country.

If castration became necessary there seems to be potential for immuno-castration to solve the castration / boar taint conundrum. I do not believe that there should be a consumer issue with the use of Improvac and it would be a useful tool to enable us to produce larger carcasses with no taint. It may be that it is something that could be used in the production of pig meat for markets which have been shown to be highly sensitive to taint.

Measuring and Influencing Quality

Measuring Quality

I visited Massey University in Palmerston North and had a fascinating day learning more about quality and uniformity.

Objective Quality Measurement

There are several elements to eating quality that can be measured objectively: colour, marbling, water holding capacity, tenderness, pH, skatole and androstenone and the fatty acid profile. It has been shown that if these factors are at the correct level then it will be a high quality piece of pork (Morel 2006).

Morel very accurately stated that "quality is only as good as the weakest link in the chain" so if you are going to brand a product you need to control the whole chain.

Subjective Quality Criteria

There are then subjective quality criteria which will not be the same to everyone and will vary between countries. These criteria include: flavour, juiciness, aroma, tenderness and colour (Morel 2006). In order to accurately assess what makes a high quality piece of pork these factors have to be studied in the country that is the intended destination. This is because the consumers in one country may want, for example, very strong tasting pork and consider it to be high quality if it is and another may think it is low quality because they want the flavour to be more subtle.

This is particularly relevant to New Zealand and Australia and their proximity to the Asian market because Singaporeans are much more likely to pick up the differences.

Methods of Measuring Quality

It is possible to measure a number of quality traits ranging from pH, to water holding capacity to protein solubility but these mostly only identify meat which is likely to be PSE or DFD which means the meat is of poor quality. They do not really provide us with a way to distinguish between average and excellent quality.

It is now technically possible to build a carcass probe that will give abattoirs the ability to evaluate and predict muscle quality (Morgan Jones, 1995). This is all very well but just because it is possible doesn't mean it is economically viable.

There are many ways that the different characteristics of meat that contribute to the overall quality can be measured but they do not measure eating quality per se. We saw at the beginning how many different elements there are to eating quality and it makes it very difficult to measure objectively in a commercial setting.

The researchers at Lacombe Research Station reported that the Australian beef grading system is a star system that adds quality throughout the chain and means they can charge more for the end product. They get more points if they hang it by the aitch bone rather than the Achilles and they get points for genetics and feed. This is a good system

as long it is linked to a way of delivering the increased value to the appropriate parts of the chain.

Major Pork Quality Defects

There are certain conditions that will ensure a piece of pork will be of poor quality. These are:

- Pale Soft Exudative (PSE) / Acidic meat. This causes the colour of the meat to be poor and for there to be high drip loss and high cooking losses.
- Dark firm and Dry (DFD). This shortens the shelf life and makes the meat prone to bacterial contamination.
- Low Marbling – This makes the meat less juicy, less tender and poorer flavoured.
- "Boar Taint" – often described as a urine-like taste and smell to the meat caused by male sex hormone and bacterial products in the fat.
- "Meat taint" – a high level of fish meal or polyunsaturated fat in the diet causing a taint in the meat.

PSE and DFD

After slaughter the pH of the meat falls, if it falls too little and too slowly the result is DFD meat. If it falls too fast the result is PSE meat and if it falls too fast and too much the result is acidic meat.

In theory it should be possible to measure pH fall in the abattoir and then be able to downgrade carcases that have an incorrect pH fall. It is not that straightforward because it is difficult to know what the optimal time is to measure pH and which technique to use. Simply measuring final pH 24 hours after slaughter will distinguish between normal, acidic and DFD meat but it won't identify PSE meat because in this case there is not a fault in final pH only in the speed of fall. The pH of normal meat is about 5.6 whereas DFD meat would be around 6.3 and acidic meat around 5.4. In PSE meat it reaches its final pH at about 3 hours post slaughter when normal meat takes the full 24 hours to reach it.

There are direct objective ways PSE can be measured – by measuring drip loss, cooking losses and colour. These measurements cannot be conducted routinely in the abattoir so it is not a practical way to assess all individual carcases.

PSE can be identified in the abattoir using prediction methods that use chemical or physical characteristics of the meat. These characteristics are pH, electrical conductivity (EC) and light reflectance (GP4). As already discussed in relation to pH the accuracy of these methods are dependent on the time after slaughter when these measurements are taken.

Light conductivity can be measured using a GP4 probe which is the probe they used to use in New Zealand.

In Denmark they claim to have removed nearly all the PSE and it is difficult to find DFD in Danish abattoirs (Marchen Hvid, conversation, Danish Meat Research Institute June 2006).

Genetic Causes

The RN minus gene in Hampshire pigs also causes acidic meat and the halothane gene is one of the major causes of PSE meat. The halothane gene is a single mutation on chromosome 6. If the halothane gene is present then the yield of meat from the pig is 3 - 4% higher. Originally the presence of this gene was detected using anaesthesia and then by looking at the DNA. The gene was more prevalent in Peitran and Landrace. This is the reason that all stock is now halothane negative and why it is important to select to eliminate the RN minus gene as well.

It is interesting to note that it has been found that pork from pigs positive to the halothane gene had a significantly lower overall palatability than pork from halothane negative pigs (Jones et al (1991)).

Managing PSE

PSE is exacerbated by stress so the aim is to have the pigs as calm as possible at the time they are killed. Stunning using carbon dioxide is therefore better because it reduces the incidence of PSE (Morel 2006).

Morel (2006) reported on some work done on PSE in which two pigs were taken at a time from different pens, mixed and then left them in lairage for 2 hours before they were killed. The result of this was no incidence of PSE. Morel (2006) reported that this suggests that transport affects PSE more than fighting and that the length of time taken in transportation of the pigs doesn't matter as long as they are in lairage for 2 hours before they are killed.

It is known that the use of electric goads also increases the incidence of PSE. Ian Barugh was disappointed to hear that there were places in New Zealand that were still using them. He thought that they had dealt with this issue and persuaded lairage staff to use other, better ways of encouraging pigs to move. He said that around Palmerston North they were not using electric goads and they were also loading in stable groups.

Nutrition also plays a part in the prevention of PSE and giving a feed supplement of magnesium and Vitamin E helps to reduce the incidence but it must be removed from the feed 6 – 24 hours before slaughter (Morel 2006).

Factors Influencing Quality

Pre-slaughter handling

The way a pig is handled during the time immediately before slaughter influences the quality of the carcass and the meat (Murray and Jones 1994). The incidence of PSE in the meat can be reduced by restricting the feed intake for up to 48 hours before slaughter. The disadvantage of restricting the feed intake for this time is that it substantially reduces the yield of the carcass (Jones et al 1998 in Murray and Jones 1994).

Lean muscle quality can be improved by resting pigs for 2 – 6 hours when they arrive at the abattoir (Warriss 1985; Sackman et al 1989; Eikelenboom et al 1991 all in Murray

and Jones 1994). Mixing pigs in lairage causes stress which, in turn, may lead to PSE pork if the glycogen levels in the muscle are high at the time of slaughter (Honkavaara 1989 in Murray and Jones 1994). This is made worse if the stress is chronic or occurs at the same time as the withdrawal of feed for extended periods (Murray and Jones 1994). Pigs that are mixed following a 24 hours feed withdrawal period were shown by Warriss and Brown (1985) (in Murray and Jones 1984) to result in substantial superficial carcass damage caused by fighting.

Chilling

Jones et al (1991) carried out research to assess the differences between blast chilling and conventional chilling on carcasses. They found that rapid chilling had no consistent effects on muscle quality – specifically drip loss and protein solubility, which are indicators of muscle quality, were not affected by rapid chilling.

Jones et al (1991) found that rapid chilling significantly reduces the amount of carcass shrinkage during cooling although they do point out that James et al (1983) and Swatland (1983) (both in Jones et al 1991) both found that the same shrinkage reductions can be achieved by the applying water sprays during cooling.

Pigs can cold-shorten when they are chilled which causes the meat to be tough. This means that slower freezing is better for tender meat but blast chilling has its advantages because it reduces the chance of PSE (Lacombe Research Station, 7 December 2006, Alberta, Canada).

Other ways to produce a higher quality product

Intramuscular Fat

The optimal level of intramuscular fat (marbling) for palatability is 2.5%. It gives a positive effect on juiciness and flavour. Duroc pigs are good for producing meat with marbling. Synthetic breeds only produce 0.97% marbling and a Duroc cross gives 1.38%. The best cross for marbling is Landrace / Duroc and the worst is Landrace / Pietran (Morel 2006).

In Switzerland they have managed to select for leaner pigs with more marbling in their genetics. They have been paying for the correct pH and fatty acids since 1989 and then selecting for marbling since 1990. The have managed to make a genetic improvement of +0.3% intramuscular fat in the Large White and +0.2% in the Landrace. Pork production is a very big industry in Switzerland and Morel reported that the pork is very good quality. Perhaps this is why pork consumption is very high in Switzerland: people eat half a pig per person per year.

The levels of intramuscular fat and eating quality were measured by killing pigs and then dissecting them and cooking the pork which was very expensive but it was run by the government. This means that in Switzerland they now produce very high quality pork (Morel 2006).

Management on farm can also increase intramuscluar fat (IMF) - feeding ad libitum rather than restricted is known to increase it while gender also has an effect - a castrate has more IMF than a female and the entire male has least of all. The amount of IMF also varies between breeds - Duroc or Duroc crosses have more IMF as already discussed, there is a major gene in the Meishan that leads to more IMF and finally, as discovered by the Swiss, you can select within pure bred pigs for higher levels (Morel 2006).

It is possible to use a fibre optic probe to measure marbling. The probe must be used at a different angle to the grading probe so that it cuts across the marbling (Lacombe Research Station, 7 December 2006, Alberta, Canada).

The Danes were assessing marbling by measuring conductivity on the line but it is difficult to achieve because the line speeds are too high. (Robertson, Lacombe Research Station, 7 December 2006, Alberta, Canada)

Polyunsaturated Fatty Acids (PUFA) in Pork

Pork that is high in PUFA is beneficial to human health because n3 PUFA (Omega 3s) decreases the incidence of heart disease. The disadvantage is that they have an adverse effect on fat quality because they affect the oxidation stability which leads to off-flavours and off-odours and they make the texture of the fat soft and liquid (Morel 2006).

PUFA in pork is influenced by genotype and diet composition (fish oil, plant oil, meat oil). You can manipulate the fatty acid profile of pork; if you increase PUFA levels in the diet you increase its levels in the back fat rather than the lean meat.

The fatty acid profile can be managed by dietary manipulation – increasing the amount of PUFA that the pigs consume increases the percentage PUFA in the back fat but the fatty acid ratio needs to be right. The fatty acid profile can also be managed by supplementing the diet with vitamin E (25mg plus 1 mg / g PUFA) and this also increases the amount of vitamin E and selenium in the loin. Fish oil is good for producing long chain fatty acids (Morel 2006).

Prairie Orchards Farms in Canada are producing pork high in Omega 3 that contains 0.3g per 100g serving (Lacombe Research Station, 7 December 2006, Alberta, Canada). At Lacombe they also reported on some transgenic pigs that have a gene that comes from spinach to make them high in Omega 3.

CONCLUSION

One of the first things I learned was that quality is a lot more complex than I could have imagined. When I set off on this journey I thought all I was looking at was eating quality. There are many more components than just eating quality. It is of little commercial use to us to produce pork that scores very highly in ethical and environmental quality if it is horrible to eat. There are only a very few people who will buy a product on those factors if the "eating experience" isn't great let alone pay a premium for it.

It seems that consumer reports of pork being dry, lacking in juiciness and easy to over cook are not confined to the UK. The indications are that the constant drive towards leaner and leaner carcases has not improved eating quality. In Canada where they are selling a much heavier pig with more intramuscular fat and a higher back fat measurement they continue to produce meat with excellent eating quality.

Genetics

We lack a national direction in terms of breeding priorities. I can buy any sort of breeding stock which might contain White breeds, Hampshire, Duroc, Pietran or even Meishan. This has happened partly because when there were many genetics companies to choose from they wanted a way differentiate themselves from the competition and partly because of genetic attempts to solve problems like PMWS. Very few genetic lines have been developed with eating quality in mind. The consequence of this is that it is very difficult for producers to produce uniform pig meat if everyone is using different genetics.

We need to develop a national breeding programme with the key factors being production performance and the eating quality of the meat produced. Having a more cohesive approach would mean that our whole industry is moving forward in a united way to produce a more uniform product with a better eating quality.

It has been shown in many countries that the pig that produces the meat with the best eating quality is a white breed (Large White or Landrace crosses) crossed with a Duroc.

Castration

Although our supermarkets are happy to sell pork and pork products that have come from castrated animals I believe that we are right in the UK to not surgically castrate. There are as many research projects that say we have or should have a very small or no problem with boar taint as there are ones that say we do have a problem. It may become a problem if we have the opportunity to export meat to a taint-sensitive country, in Asia for example, or if we want to increase our carcass size.

If a return to castration becomes necessary then we should seriously consider the immunological option which Pfizer are working very hard to get licensed in Europe. We should only start down this road if there are sound economic reasons for doing it and I'm not sure that just the alleged production advantages are enough. We must be extremely careful however that we do not end up in a situation where it is legal in Europe and the rest of the world and not here.

We should be prepared to answer any concerns about the vaccination from the media and consumers candidly because there is nothing to hide.

Supply Chain

As an industry we have become fragmented – not only do we lack vertical integration but we lack a cohesive approach. We all call ourselves pig producers – we produce pigs – some one else produces pork with our pigs and it's their job to market it and sell it well and we feel they jolly well ought to do better for us. This is the way it is but it should not be like this.

It is well known that we have a complete lack of control in our supply chain apart from one or two well-known exceptions that are fully vertically integrated. The lack of control in our supply chain makes any improvement in quality very difficult to achieve because, as we have seen, it is contributed to by each and every part of the chain and to be able to produce pig meat of the very highest quality requires attention to detail in all those parts. There are one or two well-known companies who are the exceptions and are fully vertically integrated and, therefore, have control of the whole chain. These companies have managed to produce an allegedly high quality differentiated product to individual retailers and are attracting a premium for it.

The Danes all speak with one voice – off the same hymn sheet. They all believe in their product – that people should buy Danish because it is better. We all know people should buy British but do we know why? I thought before I embarked on this trip that people should buy British because it is British. Wrong. People should buy British because it is of very high nutritional, ethical and environmental quality. It is also local (you may laugh but British is as local to us in terms of geographical distance as New South Wales pork would be to Australians in Sydney), it has low food miles and its fully traceable. If we can persuade all our abattoirs to invest in the technology and embrace the recommendations that have been shown to improve eating quality then the product produced will be even better.

Abattoirs

Abattoirs have been shielded from change for many years by being able to maintain their profit by ensuring that the price they pay for their raw materials mirrors the end price of the product and that they move in tandem. It is necessary for the profitability of the whole chain that they invest in the necessary technologies and embrace the recommendations, such as those set out in the Blueprint for Quality British Pork, in order to improve the quality of the product.

We need to ensure that the abattoirs follow the advice on how to look after pigs when they arrive and while they are in lairage because this is critical to producing a high quality product. This means that they will have to implement, if they have not already done so, strict rules for employees who work in this area particularly regarding the movement of pigs and the use of goads and ensure they are adhered to.

I do feel that we are let down by our abattoirs both in the way they kill and process our pigs and the way they buy and sell the raw material and the end products. The abattoirs need to invest appropriately in mechanisation and chilling and processing facilities to enable them to produce the best quality product. They also need to add value to less

popular parts of the carcass, such as the shoulder, by developing new products to increase the overall value of the pig.

Improving Retail Value

There are many possibilities for ways to add value to pork and pork products by improving the nutritional quality whether it is adding omega 3 or trace elements like selenium but in order for this to be a success it is important to demonstrate that there is a market for the product that is proposed rather than producing it and hoping it sells.

There are one or two abattoirs / processors that have developed value added lines but inevitably if they add the value they get to keep the premium. So the only option is for us either to own the brand or for us to have a price that reflects our contribution to increasing the value. This is now being done in some cases – non-GM or outdoor but these are still reasonably limited. We need to develop an added value line for the commercial (indoor) producer.

The most crucial part of any product development is to understand the consumer to whom you are targeting the product. It would be no good if the Australians did market research in their own country and decided as a result to stop surgical castration and then expect the Singaporeans to then be happy to continue importing it.

We are still in the situation where the retailer decides what to promote in store. We often find examples of them promoting loins when it would be better for us if they promoted a less popular lower value part of the carcass. We could look at the Australian model where they co-fund promotions on Australian pork which could be tied to a commitment to the Mark of Distinction.

We know that the way people eat in terms of cooking methods and circumstance has changed. It is crucial that we keep British pig meat innovative and exciting through product development particularly if we want to be able to fully meet the needs of the foodservice and ready meals sector.

Moisture Infusion is a good example of using a process to improve eating quality. Moisture infused pork is much juicier and is much easier to cook than ordinary pork. It seems to be well suited to the convenience, quick-to-cook market particularly when it is combined with a sauce or marinade.

The Low Fat – High Eating Quality Dichotomy

I think that it is difficult to produce pork and pork products that are very low in fat and have very good eating quality but as we have seen in Australia and New Zealand moisture infusion may be the remedy for this.

There might even be a way we could have a two tier pork market – one product that is very low in fat and has been moisture infused to make it eat well that can be cooked quickly and easily – this could compete with chicken and would make a good mid-week meal solution. Then a second sort of pork that has a higher intra-muscular fat level which cooks well but needs care taken over it which would taste great and would compete with beef and lamb for the weekend / Sunday / special occasion meal solution.

Mark of Distinction

The Mark of Distinction is good in principle but, in my opinion, it needs to say more about what's in the packet than how the pig was produced. People buy food because they like it and they will pay more because it's better. This may then be able to be combined with ethical quality but this ethical quality is not, except in a very few examples, a driver for purchase.

Marketing and Branding

One of the most important parts of selling a high quality product is good marketing. It is important that people feel that they are not only buying a high quality product but are buying in to an ethos or a lifestyle and that by buying this product they will feel better. There was a fabulous example of this over Easter; Radio 2 carried a "news" item that Leeds University had conducted research and had found that the bacon that makes the best bacon sandwich was Danish. And what should also come as no surprise is that the Danish Bacon and Meat Council sponsored the research. Brilliant, it was well worth the money they paid for it for the result to be reported on the BBC on the morning of bank holiday Monday and then again on the breakfast show the next day – that's advertising that money can't easily buy. It is important, however, to remember and notice that "Danish" is not just a word that describes something that originates from the land of the Vikings but that it is a BRAND. If I wanted to go to a retailer and buy some of this bacon for my sandwich I can do so very easily, I just look for the Danish logo. In the same way that if I want baked beans I look for Heinz or Walkers for crisps. This is important because you know what it's going to look like; you can identify it easily which is important because as we said in the beginning the consumer takes 10 seconds to decide what to buy.

How do we know how to buy British – its not easy, it could be written in tiny letters, on the back of the pack, if at all; the pack could be any colour or called Tesco , Sainsbury, Asda, Walls or Waitrose. It could look, to all but the most seasoned country of origin spotter, identical to a similar product from Holland, Sweden or Denmark or, perhaps, somewhere more exotic. If you're really lucky, it will carry the Mark of Distinction but this may be small, monochrome, on the back or completely absent.

What we need is a brand. What do we want that brand to say about the product? That it's British, yes, but what do we really mean by that? THAT IT IS BETTER.

How do we go about it? Lets take our new British Brand and call it something (we know we can't call it British) – so how about Better? We are going to produce Better pork, bacon, ham, spicy sausage you name it we'll produce it. For it to have a high ethical quality it is going to be produced to a set of production standards by some authorised producers, the genetics will be similar, the feed will be similar, the environment in which it is reared will be similar, the pigs will meet strict weight bands. The pigs will travel to an authorised abattoir in stable groups, they will be laired for one hour, group stunned by carbon dioxide and then killed. The product will be chilled slowly and treated in an identical way post slaughter in all locations. It will then be packed in Better branded packaging and sold at a premium. The producers need to own the brand and contract out the killing which must be done as laid out in the standards. The producer will be paid a premium for producing to those standards. The product will be invested in; developed, new products will be devised which will add value to cheaper cuts either through

marinades, or Moisture Infusion or whatever. The most important thing is that Better pork will not become the standard – those able to supply in to it must meet strict criteria – it is important that it is only available to the best producers and that those who do not maintain acceptable standards will be dropped. Better pork will be aimed at the more expensive end of the market. As Better pork's popularity grows more producers can supply the brand. Ideally, the goal is for the demand for the product to be such that all producers who want to supply the brand are able to although some will have to invest to bring them up to the correct production standard.

Recommendations

When I wrote my topic I did so with producers in mind and as such my recommendations reflect that.

1. A national breeding programme should be implemented. The breeding objectives should be set by a national committee and their aim should be production of the highest quality meat combined with the excellent performance targets designed to produce these pigs as profitably as possible.

2. We should not go back to castration without first demonstrating a requirement to do so from the market we wish to supply. If this is a UK market it should only be done in conjunction with an increase in carcase weight and be tied to a financial incentive for the producer.

   We should only consider a return to castration in certain circumstances:

   - If an export market becomes available to us which has castration as a requirement – such as Asia.
   - If it is be part of a set of criteria for the production of pigs for a specific premium product.

   There are two further conditions that must be satisfied. Firstly, in either of these circumstances the premium paid to the producer must be in excess of the additional cost. Secondly, if a return to surgical castration is proposed then a comprehensive revision of the method must be undertaken to ensure that it is compliant with our higher standards of welfare.

3. We must continue to find ways to improve welfare to enable us to maintain the highest ethical quality in the world. In doing so, however, we must be mindful of the cost effectiveness of any decisions and those decisions must be based on empirical evidence from sound industry-based research.

4. We must seriously encourage the development of branded products that are producer owned and based on similar production systems and post-farm gate treatment. These must only be sold in to premium markets and must be backed up by product development, innovation and marketing.

I have thoroughly enjoyed my Nuffield Scholarship and I had no idea how big an area my topic was and that there was such a wealth of information already out there. We must not be complacent about the quality of the product we produce. We must make sure that we all do our bit to improve it: producer, abattoir and processor because our future profitability depends on it.

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This leaflet provides a guide to MLC's Blueprint Specification for Quality British Pork. It draws on the results of the latest research and development work funded by MLC which gives further quality improvements and cost reductions in implementation compared with MLC's first Blueprint for Lean and Tender British Pork launched in 1992.

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BLUEPRINT *for* QUALITY BRITISH PORK

Please use the link below to access appendix

http://www.redmeatindustryforum.org.uk/supplychain/pdfs/BlueprintLeafletPork.pdf