Developments in Carcase Classification Of Beef and Lamb

A Farmers Fund Award

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Acknowledgements

I would like to thank all the people who have helped and encouraged me along the way to completing my Nuffield report.
I must start with family, my late father, my mother, my wife Sarah and sons Tom, Jack and Joe. Without Sarah's constant encouragement, support and hard work to keep the farm running during my travels, I would have not have been able to start or finish my Nuffield studies.
Our friends and neighbours.
All the people I have met during my Nuffield who have given me their knowledge and advice and sometimes, more importantly, a place to stay.
The people I have met during the investigation, from researchers and farmers to abattoir operators and supermarket buyers and butchers, for their openness….. usually!
My main sponsor, The Farmers Fund.
Additional support was received from Farmers Union of Wales, Teme Valley Tractors, Port Equip and Hybi Cig Cymru/Meat Promotion Wales.
Professors Will Haresign and Wynne Jones and Drs Lutz Bunger and Kelly Pearce, and also Rob Davidson.
The late Robin Gill former principal Welsh Agricultural College who always encouraged me to 'try for a Nuffield'. Well, I finally did.

Introduction

I was born and brought up in the middle of Birmingham, the son of a butcher. I started farming with my parents after finishing at the Welsh Agricultural College in 1984. I now farm in partnership with my wife, Sarah and we have three sons, Tom, Jack and Joe. We farm just under 300 acres stocked with around 80 mainly Limousin suckler females and around 650 Beulah females on a fragmented upland farm in the hills of Montgomeryshire, Mid-Wales. We sell store and breeding cattle and bulls alongside finished lambs, ewe lambs and rams. Since 1999 we have been selling boxed beef and lamb direct to consumers.

My Travels and the Nuffield Experience

It really has been a tremendous experience and opportunity for which I am truly grateful. I have taken 27 flights, numerous train journeys, driven and been driven many thousands of kilometres and also become acutely aware of my 'carbon footprint'. Back at Llwyn y Brain, during this period we have pletched, coppiced, and renovated almost a mile of native hedgerow and are looking at capturing shed roof water, hopefully going someway to offset my extensive travelling.
Many of my travels have been strictly related to my studies but some have been part of the overall experience. Nuffield has given me the chance to gain experiences I never thought would come my way.

China in particular was a country of extremes and a place I never thought I would visit. The first part of the trip was organised by the Australian Nuffield people. Through Aus-trade and it's interpreters we were able to get some insight into the speed of change that China and its people are undergoing. We were also lucky to be given the opportunity to see a more rural China, visiting villages that had never seen non-Chinese people and be welcomed into their homes for a feast. These people living on barely subsistence farming made me feel truly humbled by their hospitality. Still in touch with some of the students who escorted us for parts of the first week I feel honoured to have been invited to one of their weddings. Some of us also took the opportunity to teach in a secondary school, which was a memorable experience to say the least. An eager class of students which hopefully schoolchildren back in Wales can exchange views and experiences with, and both can share their cultures through some contacts I have given to our local primary and secondary schools.

Background to the Study

I approached my Nuffield study as an ordinary farmer who has always used recorded bulls and rams. We have been individually recording our Beulah sheep since 1986 and have been using back fat and muscle scanning of our lambs within our genetic improvement programme since 1997. We are now providing the abattoir with more lean meat per kilogram of carcase than a few years ago; however we are not being rewarded adequately for this under the present payment system, which is based on a rather subjective system classifying animals according to their conformation and fat score.

Establishing objective payment systems which accurately reward carcase value is of enormous importance to the sheep and beef industries world-wide. New technological developments *e.g.* video imaging analysis (VIA) systems may now provide the means not only to overcome the above concerns but may also provide the basis for a 'value based marketing system' for the UK beef and sheep sector. However such instrumental grading systems must be able to predict carcase composition with a high level of accuracy for a value based marketing system to be effective.

I first saw a pilot VIA grading system on the Meat Promotion Wales stand at the Royal Welsh Show in 2003. It struck me that this new technology could have a lot to offer British meat farmers. Could this type of system be what we had been looking for to reward us for our many years of recording and the resulting genetic gain? The Nuffield Farm Scholarships Trust has given me the opportunity to investigate this further.

I tried to take an over view of as many different grading systems as possible in the time available, with the aim of assessing their potential suitability to the UK situation. What do the various people in the chain of production think and what could they offer beef and sheep farmers? I have tried not to mention specific plants or companies because I recognise the commercial sensitivity of my subject matter. Neither am I able to provide detailed data about the various systems investigated because the openness of the vast majority of the people I encountered was conditional on not doing so.

Through the Nuffield Scholarship I have travelled to Holland, Belgium, China, Ireland, Singapore, Australia and New Zealand, as well as to various parts of the UK. In these countries I have been able visit and to speak to most, if not all of the main people involved in the meat production chain.

Aims of the Study

- to assess the current carcase classification system in the UK
- to research alternative systems of carcase assessment available and under trial
- to look at systems already in use and currently under trial
- to gauge the reaction of the industry to these technologies
- to look at the benefits and disadvantages of these alternative systems to the UK
- to draw conclusions and suggest recommendations for change to the UK systems

Our Experience of Carcase Improvement through Selective Breeding

We have been using recorded bull semen through AI since the early 1980s and individually recording our Beulah flock since 1986. This flock recording was further advanced in 1996 when, through the Welsh Sheep Strategy, we became one of the founding member flocks of The Beulah Sire Reference Scheme. This has involved more detailed measuring of both maternal and carcase traits. Along with back fat and muscle scanning we have, on occasion, made use of the CAT scanner at The Scottish Agricultural Colleges facility near Edinburgh. This has culminated, so far, with the breeding of our ram 'The Tank' who, along with improved maternal traits, is passing on his high growth rate, deep rib eye muscle and reduced fat levels to his progeny. He is the highest index Beulah ram among recorded flocks in the UK at this time.

'The Tank'

8wk wt EBV kg	Mature EBV kg	Maternal EBV kg	Scan wt EBV kg	Musc dp EBV mm	Fat dp EBV mm	Index
2.95	8.69	1.13	5.41	2.46	-0.48	311

Figure 1 Homebred high index (carcase and maternal) ram

Unfortunately the current carcase classification system in the UK tends to reward hindquarter shape and is unable to take account of meat yield. This has lead to my interest in a system which I feel would reward our years of trying to improve the meat yield of the stock we produce. We are able to take some comfort from the increased carcase weight and the increased size of the eye muscle in the beef ribs and lamb loins that we sell direct to our private customers. It is pleasing to note that many of our ram customers are also seeing improvements in their own lamb carcase weight and loin eye muscle size.

The Current System in the UK

The current grading system in the UK and Europe uses the EUROP classification for conformation and the numeric (1-5) assessment for fatness. It has been used to communicate clear descriptions of carcase specifications in the marketing chain, and it describes carcases by (i) **weight**-cold dressed carcase weight, (ii) **dressing specification** used, (iii) **category**: new and old season lamb, mature sheep, under/over 30 month cattle, sex and entire or castrated cattle and (iv) **conformation** and **fatness**. The scheme serves as a basis for a common language for specifications, and monitoring, and is designed to describe the main characteristics of the carcase without attributing any qualitative judgement. It has also been used by some abattoirs for the development of a pricing grid for producer payment schedules.

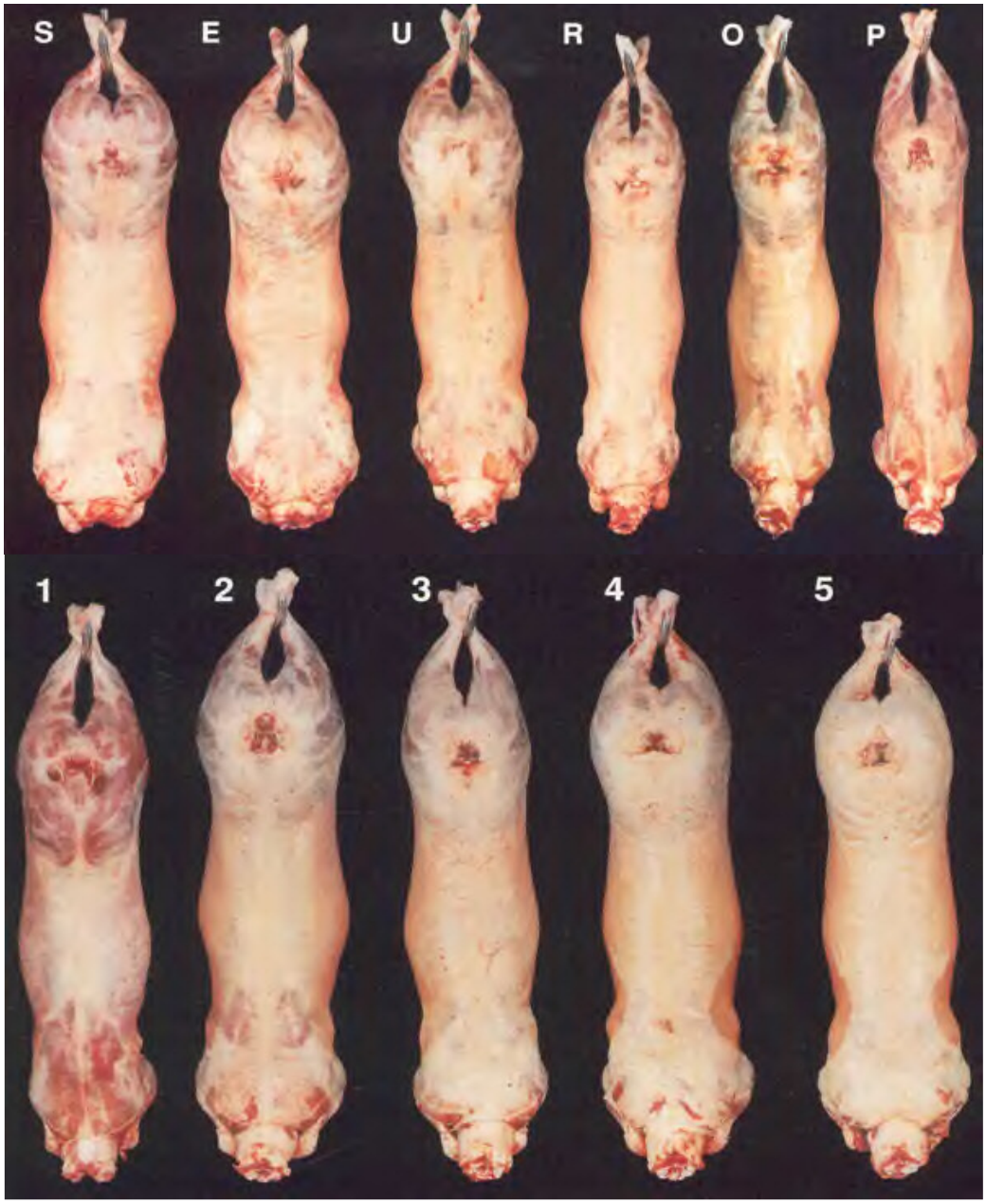


Figure 2 The EUROP grid carcase classification system. Note 'S' added for the more extreme animals graded in mainland Europe.

It was brought in as a tool for European intervention stores years ago and is also used as a legal EU requirement for beef (but not sheep) price reporting. Classification in UK abattoirs is carried out by graders, mainly trained by the Meat and Livestock Commission. Abattoirs can buy in services from the MLC but they remain independent of the abattoir. Currently 100 MLC graders work in 56 abattoirs across the UK assessing 70% of beef, 45% of lamb and 62% of pigs slaughtered. Some companies use in-house graders who they may have trained themselves and these would cover the remaining UK kill.

The current carcase classification system used in the UK for sheep and beef is entirely subjective and this leads to mistrust from farmers to abattoirs and supermarkets and back again. There is often belief among farmers that some abattoirs change their grading pressure according to the time of year and the supply-demand relationships in a given week, the number of stock you sell and for many other reasons. However, because of the subjective nature of the existing grading systems this is very difficult to prove. What is really needed is a grading system based on objective measures and preferably one not involving human intervention.

New Carcase Assessment Technologies

The main system I looked at was Video Imaging Analysis (VIA), from different suppliers such as those from E+V, Sastek and Normaclas. These use one or more digital cameras, lights and a completely still carcase to assess shape and colouration to determine conformation, fat cover and meat yield through large numbers of measurements of the carcase at specific points, and the use of algorithms to predict meat yield from the large number of measurements made.

Figure 3 **VIAscan VIA system in Lorneville NZ. Note closeness of carcase to camera**

Figure 4 E+V VIA system being trialled in Wales. Note camera to carcase distance.

There is some feeling that whilst showing acceptable levels of accuracy on conformation and meat yield, VIA systems struggle with fat assessment, although they can be augmented by other suitable systems such as near infrared spectroscopy (NIR). Another disadvantage is that if the carcase is damaged, for example during hide removal, the reading is inaccurate. Some plants then pay a batch average for these damaged carcases whilst others retain a human grader to assess the damaged carcases for payment. These systems can work at line speeds of 600-800 carcases /hour in sheep. The extensive trials at Welsh Country Foods in North Wales look very promising, especially for assessing carcase conformation and assessing lean meat yield for lambs. In Ireland 90% of beef carcases are now graded on the EUROP grid using this same E + V system.

Figure 5 E+V VIA system in Ireland. Light and shade aid measuring process.

It is worth noting that the VIAscan system operates much closer to the carcase than E+V system which could be an important consideration if abattoir space is at a premium. VIAscan operates without the line stopping momentarily for the measurement process to take unlike the E+V system.

Some grading systems assess meat eating quality as well as carcase quality and yield. The Meat Standards Australia beef grading system links rib fat depth, colour, marbling, eye muscle area, ultimate pH (5.3-5.7) and breed, taking account of the Bos indicus (tropical cattle) genetic influence affecting toughness. Meat and Livestock Australia feels that this gives a more 'all round' picture of carcase, meat and eating quality. Their technical data show that there is a strong link between eye muscle area and overall carcase meat yield. The marbling and rib eye area is often assessed by camera. Work is also being carried out at the Clay Centre in Nebraska looking at marbling and maturity in beef using infra red assessment to look at the meat fibres to judge tenderness and meat eating quality.

X-ray Grading

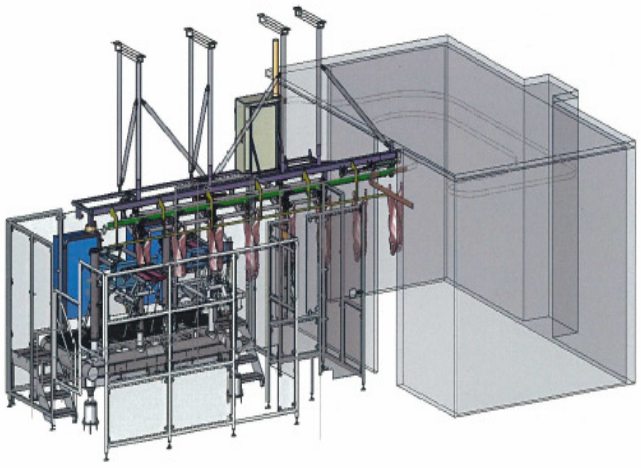
Probably the most exciting discovery of my travels was the use of X-ray scanning on the slaughter line. This system is linked to robotic arms for further carcase dressing and cutting whilst still achieving high line speeds of 600+ carcases/hour. Currently the system uses a single energy X-ray unit coupled to an automated carcase breakdown and leg boning system. There are plans to upgrade to dual energy X-ray which would mean better meat: fat: bone composition data. In addition video cameras to create 3D images are also underway. This system should be able to 'see through' the meat to identify animals with increased muscling due to single gene effects such as Myomax® and Loinmax®.

Within 2 years this system should offer conformation, meat: fat: bone ratios and ultimate pH, the latter of which will give a measure of chilled shelf life. Looking further ahead, rapid DNA and muscle biochemistry tests will be available to give more precise information on meat eating quality. This information can then be fed back to producers to help improve quality as well as determine payments. The robotic route has come about for a number of reasons, not least hygiene. However, in some parts of the world drug taking by staff is also becoming an increasing problem in meat plants; indeed some plants have now started drug testing their staff for health and safety reasons. The increasing use of robotics offers the potential to reduce the impact of such problems by reducing the number of staff required.

I have also looked at CT scanning, back fat, muscle ultrasound scanning and dexa dual X-ray scanning that is being used further back down the chain to evaluate carcase traits in live animals to aid genetic selection for carcase traits in order to breed better stock for the meat trade.

During my travels I was able to witness similar developments of computer based grading systems for pork, tomatoes, avocados and kiwi fruit. Although outside the main aims of this Scholarship, these experiences indicate that computerised systems are being more widely adopted across a broad spectrum of agricultural outputs. At all of these sites across the world it was felt that these systems could provide an objective view which gave clear indications to grower and buyer of what was required by the customer and thereby gives real unmoving targets for the producer to strive for.

Figure 6 X-ray and Primal Cutting System



X-ray Primal System

Carcasses are scanned using x-ray technology. From this, a 3D spatial image is generated for Forequarter reference cut height, roll and pitch to ensure maximum yields are obtained by cutting between and following the ribs. Cut positions for the Hindquarter are also determined from the x-ray for either Chump on, Chump off or Scallop cut.

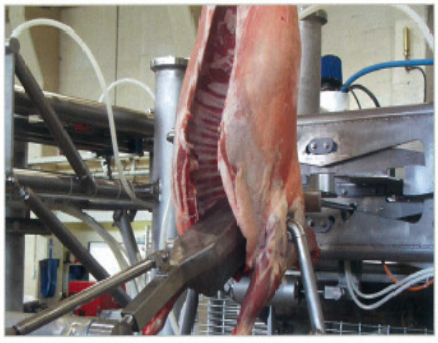
This x-ray data is digitally analysed and tracked through the process to ensure the appropriate data is provided to the cutting station along with the correct carcass.

In future stages of the RTL boning room, x-ray data will follow the carcass and its pieces beyond the Primal machine to include the Hindquarter, Saddle and Forequarter systems to ensure optimum yields are achieved at all stages through the process.

System Specifications & Benefits:

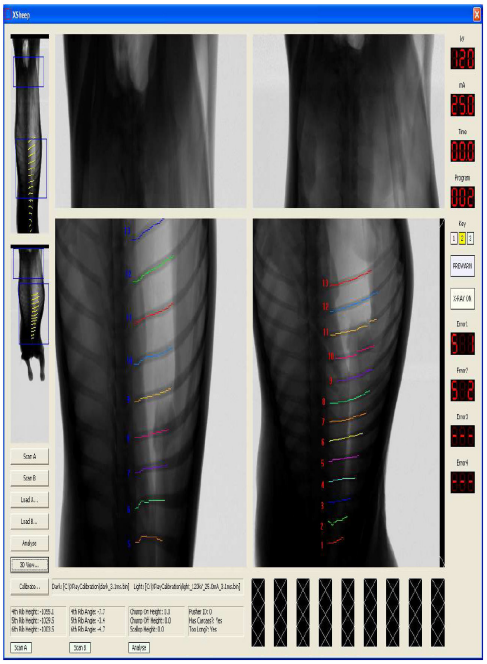
- Production throughput of 10 carcasses per minute.
- Major Yield and labour saving benefits.
- Payback in the order of 12 to 18 months, depending on utilisation.
- Consistent cut accuracy and quality.
- Improved shelf life of product due to reduced saw paste.
- Significant O H & S benefits (band saw replacement).
- Integrates and enables RTL's automated boning room vision.
- X-Ray provides enabling technology for the future boning room.

Forequarter Station Cutter



A clamped carcass about to be cut by the RTL Forequarter Station Cutter.

SINGLE ENERGY X-RAY IMAGE



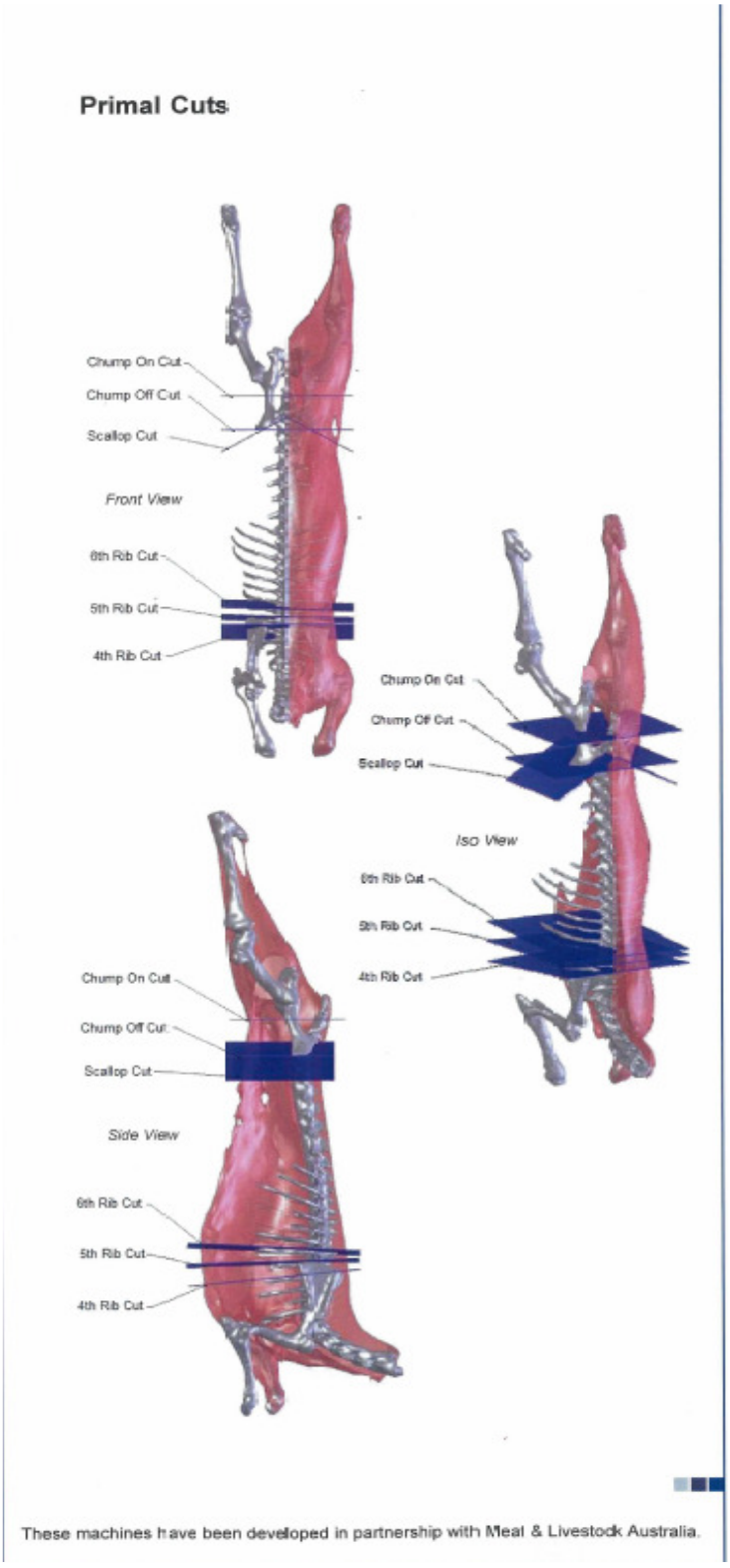


Figure 7 Cutting points for robotic boning and carcase breakdown

Superior Quality & Cutting Accuracy

RTL's Automated Boning Room Vision

The x-ray Primal system is the first stage of RTL's automated boning room to be commercially released.

Hindquarter machines form stage 2 of the project, with current prototype machines in production and scheduled for commercialisation late 2007.
Middle processing prototype work is well advanced with production prototypes planned for release during 2008.

Forequarter processing form the final stage of the boning room vision and is scheduled for 2009.

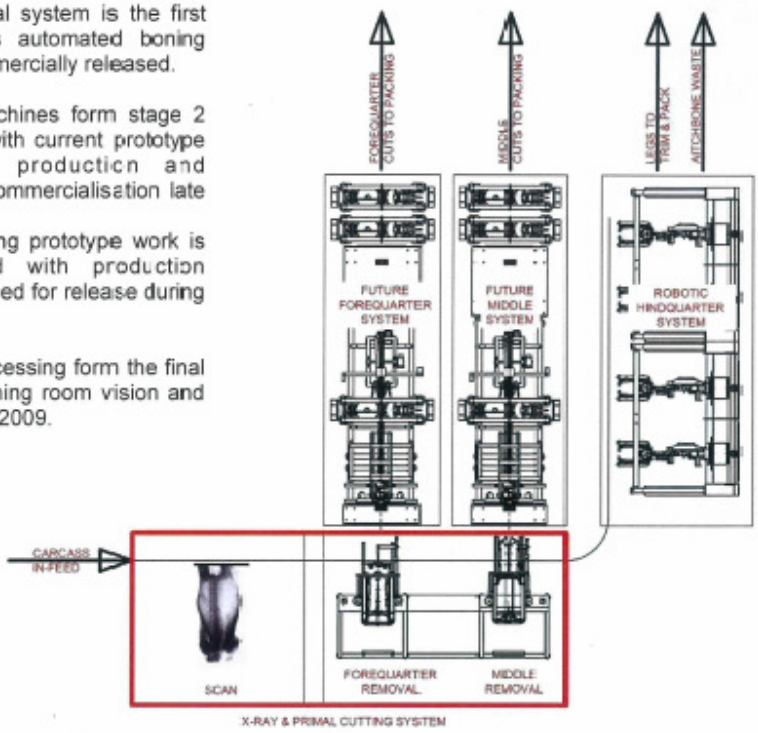


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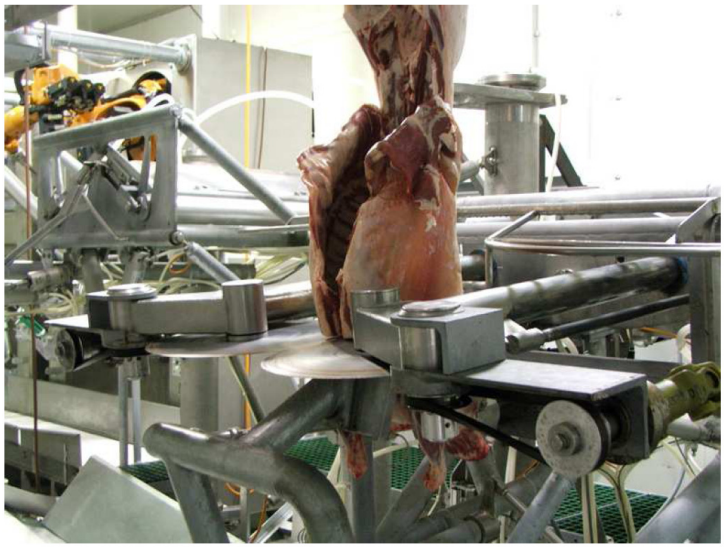
Figure 8 Robotic boning room layout

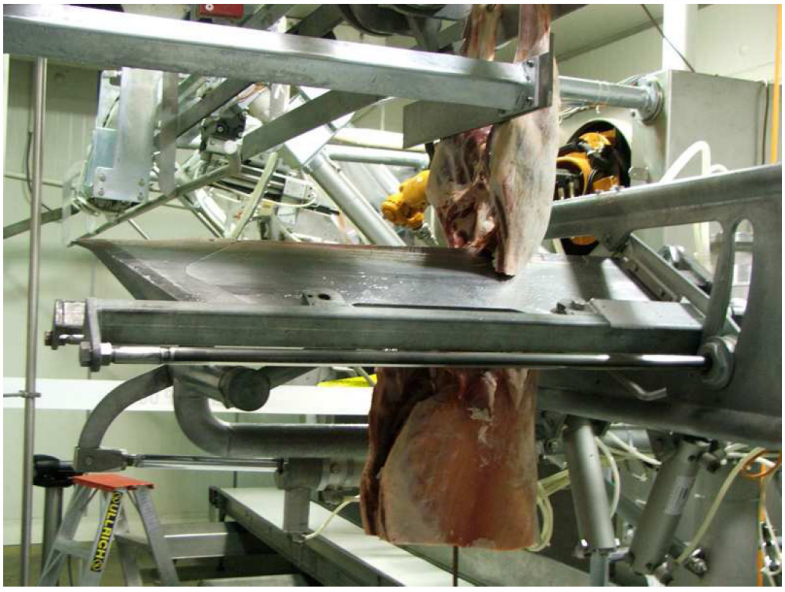
Figure 9 Robotic Boning

Computer software links individual carcase data from the x ray grading unit to robotic arms at the cutting stations to ensure accurate and consistent carcase breakdown into primals.

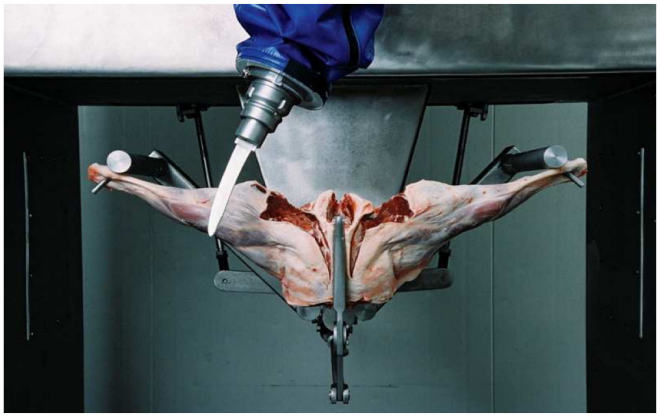
RTL Primal Breakdown - Fores



RTL Primal Breakdown - Hinds



Hindquarter Boning



The Situation and Systems in use in the Countries Visited

China

I saw extremes of slaughtering facilities as in other facets of our brief snapshot of Chinese life. The largest abattoir I visited was single species for pork. Owned by American shareholders, it was state of the art with a viewing gallery throughout the plant for visitors.
Meetings with leading players in Chinese agriculture and agricultural politics showed great interest and an eagerness to move towards a more yield based payment system, which would enable abattoirs to better monitor the speed of the country's genetic improvement programme across the whole livestock industry. It is important to note that China farms the worlds' largest sheep flock and now also beef herd. As we were constantly reminded, the population aspires to better food such as beef and lamb as much as they wish material improvements in their lifestyle.

Australia

My visit to Australia in November 2006 was against a background of the worst drought conditions in decades and since then the national flock has fallen to its lowest level for 90 years.

The University of Armidale meat technology department was an early visit on my trip. It was here that I first learned the detail of the Meat Standards Australia (MSA) Grading. Up until 1996 there was no standard grading system. Meat and Livestock Australia came up with a whole life standard, from conception to eating, linking rib fat depth, colour, marbling, eye muscle area, ultimate pH (5.3-5.7) and breed, taking account of the Bos indicus (tropical cattle) genetic influence affecting toughness. Meat and Livestock Australia feels that this gives a more 'all round' picture of carcase, meat and eating quality. Their technical data show that there is a strong link between eye muscle area and overall carcase meat yield.

Almost all of the plants I visited were using or trialling Video Imaging Analysis. I was told that the best producers could not wait to move over to meat yield payments. Producer groups are being used to help with the lead in and to assess perception within the industry. Some producers will gain but of course, as the pot of money available to plants to pay farmers is limited, some will lose and these losses could be significant unless managed carefully. The counter to this is whether the current system of payment, which effectively takes income from those producers supplying high quality carcasses and using it as a subsidy for those who do not, is morally justifiable. Some were using VIA alongside other measures such as in beef rib eye measurement, (either by camera or physically measuring) and/or fat probes. The fat probes varied from a simple gauge pushed into the carcase to an electronic probe. Most used some form of electronic stimulation to age the meat and also washing before and sometimes after hide removal was commonplace. A common theme among plants starting to use VIA was a transition period to allow producers and the plant to adapt to the new system. Farmers received the traditional grade sheet for payment with meat yield predictions also shown. One 'sheep only' plant I visited had been paying on primal meat yield for around 6 years. This was one of the few plants I came across that had made the 'leap of faith' to paying entirely on meat yield. The family owned plant started out as domestic butchers and now kill around 20000 units per week on a 600/hour line speed. The aim is for 5mm of fat and a 23-27kg carcase weight. The abattoir used the Sastek VIA system and had been heavily involved with Meat and Livestock Australia in the development of VIA and its commercial take-up. Damaged carcases were paid on the batch average**.** Selective breeding and genetic improvement systems for increasing carcass quality do work. I was assured by one plant that they have the data to demonstrate this. Improvement in eye muscle in the loin should always be the aim to increase revenue for this abattoir's suppliers.

The Australian 'Lamb Plan' recording system was favoured by the top producers supplying this plant because it designed to deliver such improvements through selective breeding.

Figure 10 Fat probe used in many Australian and New Zealand abattoirs

Another plant I visited was farmer owned and moving over to yield based payments by the 2009 season. A key and unique feature of this operation was the post of 'Supply Development Manager'. His role was to liaise with individuals within the production chain, giving advice to producers from optimum grass seeds mixtures to breeding sheep purchasing, but also feeding back their views to the plant management and directors. It seemed clear to me that this organisation wanted to make the most for all involved in the production process and improve the product for the consumer. Each grade /payment sheet has a scatter gram (see below) attached so that they get an idea of how they will be rewarded as the cooperative moves towards yield based payments. It is also interesting that they ask for feedback through the Supply Development Manager. Indeed, some producers are already asking for a more detailed breakdown of carcase meat yield into forequarter, loin and hindquarter meat yields to aid sire selection.

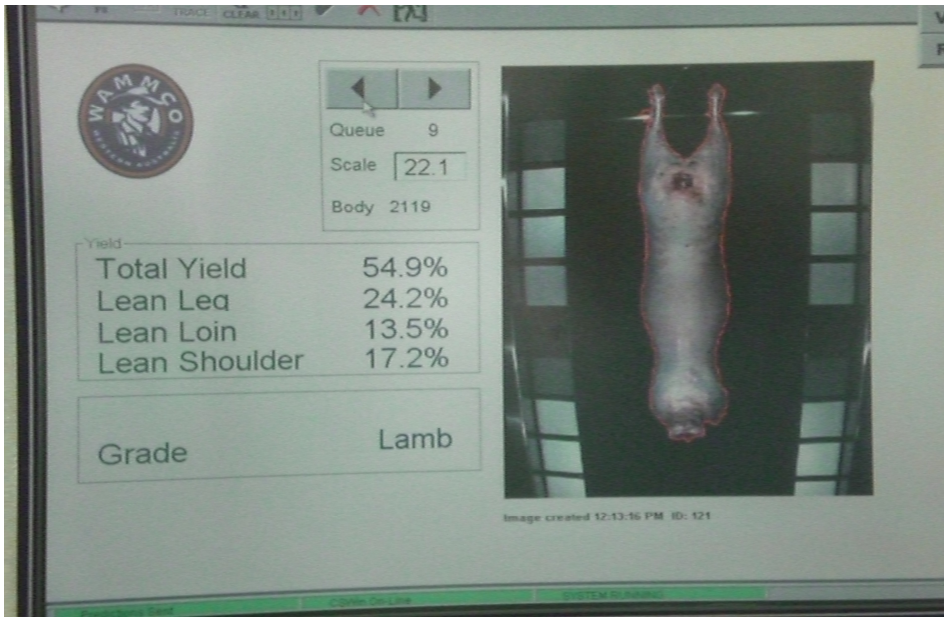


Figure 11 Computer screen displaying primal yields on VIAscan system

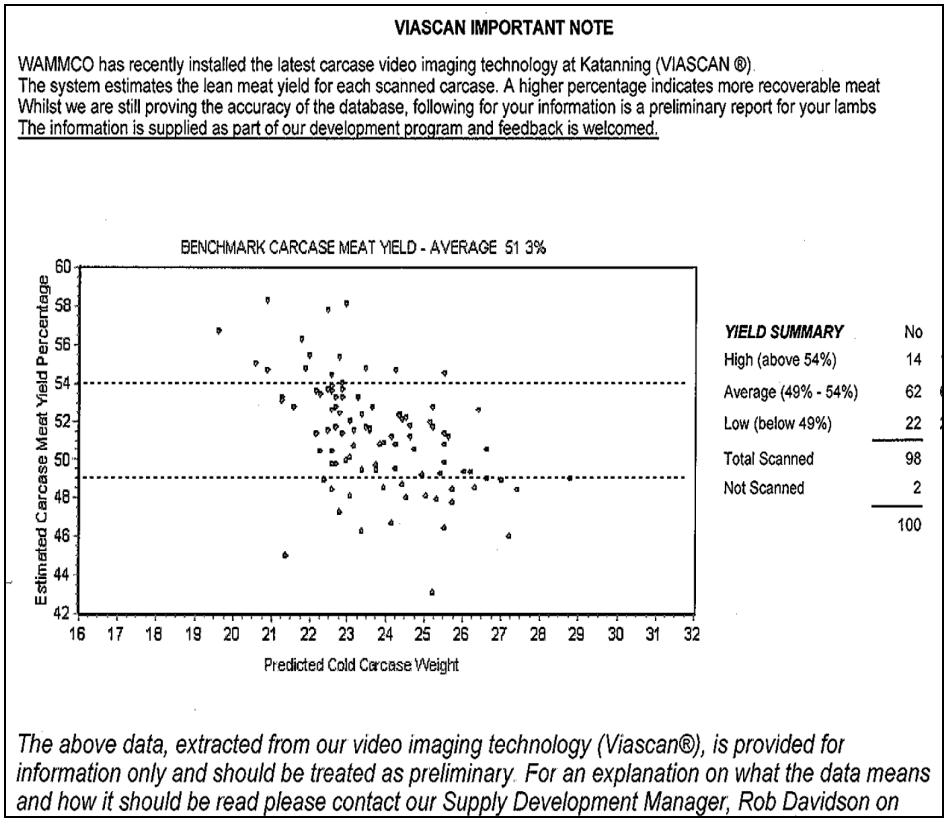


Figure 12 Scattergram showing batch performance on the producer payment sheet.

Tasmania

I visited the largest tomato grower on the island who had installed a computer system to grade his crop by size, colour and shape to meet different customers' requirements. He was very satisfied with the system, its speed and overall reliability.

New Zealand

New Zealand's sheep and beef farmers are under ever increasing pressure, particularly from the huge increase in the national dairy herd and the speed of conversion of farms particularly from sheep to dairy. The national flock is falling, with breeding sheep numbers in many flocks dropping by 20% if not being sold completely. This will obviously hold concerns for abattoir operators large and small alike. Lower lamb numbers will affect throughput and some plants may operate fewer chains or close altogether. This of course will affect the speed of uptake of new technology and the money available to fund developments.

Despite this, all the big players in the New Zealand meat industry are looking at, trialling or already using new methods of beef and lamb carcase classification in an effort to get the most from the carcase and give a truer indication of its worth to the farmer and the plant. When I

visited the worlds largest lamb slaughtering facility they already were partway through a two year transitional period towards yield based payments. Producers during this period get paid on the traditional system, but are also given an indication of predicted payments under the VIAscan system, as happens in some Australian plants. However, the top producers bringing lambs that killed out with the top percentage meat yield were already being paid a bonus on top of the existing payment schedule. I was able to speak to some farmers who had lambs in the plant on the day I visited. One gentleman was a ram breeder and was already breeding composite rams for his customers with a view to capitalising on the new system. He felt that it was a positive way forward for the abattoirs (mainly farmer shareholder owned in New Zealand), the producers and the plant's customers. However, another farmer was more sceptical and was acutely aware of the pressure New Zealand's sheep farmers were under and, although he hoped that some would gain under the new system he was concerned that some would inevitably lose. A worst case scenario view held by some was be that whilst producers of lower meat yielding lambs would get less money under a new system, it may be that the top producers would get no more. In other words, this new payment system would be used to improve the margins of the abattoir not to redistribute money among producers.

One of the beef plants I visited had been using VIA for some time and as with some of the Australia beef plants, were using hot boning techniques to improve the yield as the bone could be removed more cleanly whilst the carcase is still warm. The main disadvantage to this is that the meat loses its shape. The meat is then 'aged in the box' *en route* to customers. This plant also scanned the boxed meat prior to leaving the plant and then boxes are labelled with lean meat yield and priced according to weight, cut and yield. This group seems to be working intensively with some of their farmer share holders, particularly ram and bull breeders. For many years they, and other abattoir chains in New Zealand, have been involved in carcase breakdown, to improve sire selection for meat yield and eating quality and also looking at DNA markers for meat tenderness, eating quality, and muscling among other things. They have a strong feeling that influencing these large ram and bull breeders will quickly improve the lamb and beef they have to sell.

Whilst in New Zealand I was made aware of the X-ray grading system being developed by one abattoir group (details noted previously). I am grateful to Grant Pearson of the PPCS Group (now Silver Fern ™ Farms) for giving me permission to include these developments and the following diagram/photgraphs in my report. The group hold regular field days with suppliers.

I also visited a kiwi fruit and avocado grading and packing warehouse. The expansion here was impressive under the brand name Zespri®. Local farmers were selling at the premium end of the market especially to Japan. A computer grading system, again using cameras and lights, assessing size, shape, colour and weight for high speed sorting had been operating successfully in recent years. The pack house operators were pleased with results and a 1-3% tolerance level for blemished fruit was accepted. Other pack houses were also using infra red cameras to look for any damage to the fruit. The system here called 'Compac In-Vision' looked at the surface area and shape using pixel differences and contrast to grade.

Ireland

Ireland brought in VIA in beef grading some years ago with a grant aided scheme to help abattoirs pay for the E+V systems. The aim was to save government money on paying manual graders in the plants. Most plants took the opportunity of grant aid to put in a system and now well over 90% of beef in Ireland is graded in this way. The system is being used to grade on the EUROP grid which, as I have stated before, does not make best use of a system designed to predict meat yield. The common complaint was that fat assessment is not good enough. Like many plants I visited around the world, it was just a way of paying farmers and the grade was of little value after the payment point. Some farmers and their representatives were sceptical of the VIA system. Press reports from some felt there had been a reduction in some of the higher value

grades since its introduction. The counter argument to this was that these complaints were coming from areas where human graders had been particularly lenient in the past. There didn't seem to be a particular desire to move over to yield based payments. This may have been due to

struggling beef and particularly sheep sectors. I believe there could be a benefit to abattoirs carrying out further carcase breakdown to move over to yield payments. Again, as in many parts of the world, there is often a lack of trust throughout the production chain which is to the detriment of all those involved. How this enormous hurdle is overcome will be difficult to address. It is to the credit of Dunbia that they have employed a staff member to work with farmers and look at new developments.

Reaction of the Industry to These New Technologies

I have tried to gather opinions from all those involved in the process from lamb and beef producers to the consumers who purchase and eat the final product. From this research it appears that the further up the chain from the farmer towards the consumer, the less important the carcase grading and classification becomes. The consumer of meat is generally more concerned about price, taste and ease of preparation for eating. Reversing up the chain towards the producer the more traditional retail butcher seems to have little concept of carcase classification and this was emphasised when I was talking to the Meat Traders Federation who had not discussed the 'EUROP Grid' and carcase classification for around 12 years. There are currently 7000 butchers' shops in the UK, having fallen from 18500 in the last twenty five years. However, this decline seems to have slowed as many consumers look for that personal touch and cooking advice that often the larger supermarkets fail to offer. There was a definite feeling that the carcases that 'local' butchers require carry more fat than those that the supermarkets are selling, 3H for fat cover as opposed to 2 and 3L for the supermarkets. The representative also felt that the drive for super-lean carcases under current weightings of beef and sheep recording systems was to the detriment of cooking and eating quality. The president of this organisation, who alongside his butchers shop runs a small abattoir, felt that most traditional butchers have built a relationship with those that supply them, whether that is farmers supplying their abattoir or the wholesalers who are supplying them direct with meat. This relationship is built on an understanding of the individuals' requirements.

Carcase grading is much more important to the initial producer primarily as a method for payment but also as a target to aim at to try and increase returns. Cutting plants not attached directly to abattoirs use it as a way of ensuring they get from the abattoir what they can make the most money from for their customers, be it supermarkets, butchers or the hospitality trade.

I have been in touch with the main supermarkets and they all had some degree of interest in new methods of carcase grading (except Sainsbury who refused to allow me to speak to a meat buyer as it was against company policy!) The most enthusiastic supporter of these new technology systems was Asda, who felt the sooner producers are paid on meat yield the better off Asda, their supplying abattoirs and in turn the farmers who supply them would all be. Many abattoirs are waiting to see what everyone else is doing. There is genuine concern among mainland UK abattoirs that the first plant to pay on meat yield will see it's competitors raise their prices to farmers, thereby drawing away farmers and hence throughput which is what larger abattoir profit is very dependent on.

One of the plant owners I spoke to from Ireland felt the biggest gain to him of the Irish move to VIA grading was that fewer farmers were entering the plant intimidating or charming the graders to get a better grade. Until there is a feeling that not only is any new system fair and consistent

but also of benefit to both the producer and the abattoir it will not be fully accepted or given credence by the industry.

Systems Costs

The costs of implementing these systems obviously vary considerably from manufacturer to manufacturer. At the lower end, in 2008 one company was offering a VIA system installation and one years maintenance for around 80 000 euros , another plant within Wales was looking at a total cost of around £250 000 taking account of altering the slaughter line layout and associated computer software.

The rise in beef and lamb carcase values during 2009 coupled with the looming compulsory implementation of electronic identification of sheep in Europe in January 2010 will seriously impact on the budgets of the UK abattoir sector. Unfortunately along with the current rapidly falling beef and sheep numbers this will surely slowdown uptake of new carcase classification systems.

Benefits of the New Systems

There are a number of potential new benefits that these new grading systems can provide:

- because they are based on objective measurements, these systems should be more consistent than the human eye from carcase to carcase and plant to plant (using the same systems)
- should be seen by producers as independent, removing much of the mistrust that surrounds existing subjective grading systems
- unlike current grading systems, they appear to have potential to assess meat yield of carcases
- the potential to move to a payment system based on meat yield will provide a fairer payments structure for all in the supply chain if the payment structure is right
- should lead to improved hygiene from less handling of carcase, leading to improved shelf life of the meat
- some systems are reset between batches to maintain accuracy and give confidence to the producer
- are able to operate at line speeds (carcases/hour) typical of the fastest currently available in the world (800 lambs/hour)

Disadvantages of the New Systems

As well as the potential benefits listed above, there are a number of potential disadvantages that will also need to be considered:

- these systems are only as good as the people who design and set them, and the accuracy of the algorithms within the software on which the evaluations are based
- damage to carcases during automated pelt removal can negate results in some systems
- some systems may struggle with wide variation in fat class and carcase size and shape, particularly with sheep
- there are problems of perception where the systems have replaced more lenient graders
- movement to a payment system based on meat yield, while fairer and appropriately rewarding those producers who ‘get it right’, will result in some producers losing out

- there may be some consumer resistance with some systems (*e.g*. meat exposed to X-rays)

Conclusions

The EUROP grid is now surely out-dated. The EU has moved on, and farming and livestock production systems have changed. In addition, sectors of the industry have embraced genetic improvements of carcase quality in both sheep and beef cattle, but are currently not being rewarded adequately for such investments. Most abattoirs that I encountered in the UK and Ireland priced on the extremes and the middle of the EUROP grid so why is there a need for so many grades?

Given that VIA is based on objective measurements, how realistic is it to calibrate it against the EUROP grid system which itself is subjective and imprecise? Indeed, the introduction of VIA systems to meet the legal requirements of the EU for beef carcase classification are only permitted as long as it is possible to demonstrate statistically that there is a high correlation between the subjective system and VIA across the range of carcase grades typical for each member state! The EUROP grid is not very good at predicting saleable meat yield whereas VIA is much better. Surely the time has come to introduce objective systems of carcase grading better able to reward producers for the meat yield of each individual carcase.

Under current UK grid pricing systems, stock of the required fat class are subsidising over-fat animals. This is because the penalties for over-fatness are only a fraction of what they ought to be based on the extra fat trim and the labour costs of removing it, the environmental and financial costs of getting rid of that extra fat, and the reduced saleable meat yield that results. Such anomalies are widely accepted within the abattoir sector, yet no-one is willing to change on their own for fear of losing throughput and hence plant viability. Conversely, they pay premiums for increased conformation on the hindquarter that cannot be justified on the basis of increased saleable meat yield, at least with lamb.

Due to the nature of the meat industry in the UK it is unlikely, without legislation, that all beef and lamb slaughter plants would move forward together to introduce a grading system based on meat yield, although I feel this would be of great benefit to the industry.

These grading systems would seem more financially beneficial to plants that are doing further cutting rather than selling whole carcases. It is probably these plants that will introduce the new technologies sooner.

Abattoirs must get the price schedule right to maintain their throughput and profitability if moving to these systems. For example, one plant I visited that was using 'VIAscan' paid 55% of the lamb carcase price for the loin, yet this is only 12% of the carcase weight. Many plants felt forequarters were worth around 50% of the value of the loin. Transparency in pricing structures will be essential so that it can lead or drive farmers in the right direction.

Attitude may be more of a problem than science when looking at the pros and cons of introducing these new technologies and moving towards yield based payments. However, in every country I visited there was an obvious desire to find more efficient methods of assessing both carcase and eating quality.

Recommendations

A number of recommendations arise from my investigations:

- there should be a gradual move towards a yield-based payment system underpinned by these new technologies
- the payment structure should be based on primal cuts rather than the whole carcase
- there will be winners and losers with any new system and producers must be given a transition period to adapt (running systems side by side)
- there is a need for improvement in automated hide removal techniques to avoid problems associated with grading carcases with such blemishes
- pay producers to 0.1kg not 0.5kg as is the usual practice in the UK
- there will be opportunities for MLC graders to oversee calibration and maintenance of machines to assure farmers of independence
- forget taste and tenderness at your peril; any new systems should involve assessment of eating quality
- develop an eating quality initiative for beef and lamb to improve the whole production chain
- data from these new technologies could be linked to stock recording programs to aid genetic improvement services provided by Signet and others, thus improving robustness of performance recording
- to get the best out of these new technologies for the whole chain it would seem sensible for meat companies and supermarkets to work with ram and bull breeders, by providing carcase breakdown and yield assessments. This would have long term benefits for all involved
- more exchange of relevant information across the industry, although difficult due to commercial competition
- a link person through the whole supply chain such as the 'supply development manager' I met at WAMMCO in Australia, to work and be involved with farmers, abattoirs and customers to try and make the most for all involved

Recent Developments

It is pleasing to note a number of initiatives since my Nuffield travels in 2006/2007:

- Quality Meat Scotland QMS are looking at a new classification system along the lines of Meat Standards Australia Grading taking into account a number of factors to try and grade beef carcases according to eating quality as well as meat yield.

- Hybu Cig Cymru / Meat Promotion Wales HCC/MPW continue to fund Welsh farmers in genetic improvement programmes from individual recording of beef and sheep to buying better bulls and semen of high genetic merit.

- HCC/MPW are seeking funding to compare VIA systems from two manufacturers in one abattoir plant in Wales in their efforts to support the industry in implementing these systems.

Where Do I Go From Here?

I am keen to try and move things forward and have already done a number of presentations to farming groups and EBLEX and also some presentations on behalf of HCC Welsh Meat Promotion. I intend to meet further with some abattoir operators. I believe that we need a system of assessing carcase quality which is fair and consistent. We need to work together throughout our industry if we are to survive. We must get closer to the consumer to build on much of the good work already done to promote beef and lamb for a healthy lifestyle and a memorable eating experience.

Since completing my travels I have been fortunate to become a board member of Hybu Cig Cymru/Meat Promotion Wales and sit on their Research and Development Committee. We have also started individual recording of our Limousin beef herd through Signet.

I am still plugging away with various bodies and plants to try and move carcase classification in the UK forward. I feel that in some ways this study will, for me, continue for some time. I hope to have some influence in driving a change in the way the UK industry looks at beef and lamb carcases which will benefit all of us who are involved, from breeders right through to consumers.

Appendix

Thanks to:

UK and Ireland

Sarah, Tom, Jack and Joe Yeomans
Doug Gethin
Gwyn and Rob Francis
Kim Mathews, MLC, Milton Keynes
Mike Owen, MLC, Milton Keynes
Duncan Pullar, MLC, Milton Keynes
Graham Shortland, Edward Hamer International
Kevin Brown, Edward Hamer International
Trevor Hanger, Welsh Country Foods
Mark Heaighton, G.O. Adams
Dr Lutz Bunger and his team, SAC Edinburgh
Alan Craig, ABP Perth
Wyn Williams, Dunbia, Llanybydder
Prof. Will Haresign, IRS UCW Aberystwyth.
Prys Morgan, HCC/MPW
Chris Lloyd, Eblex
Sam Boon, SIGNET
Robin Smith, Irish Cattle and Sheep Breeders Assn.
Eddie Boyd, Dunbia, Ireland
Padraig Browne, Dunbia, Ireland
Jim Dobson, Dunbia, Ireland
Ken Mathews, Offaly Quality Lamb Producers Co-op Soc. Ltd.
John Heel, MLC
Chris Brown, ASDA
Duncan Sinclair, Waitrose
Rob Cumine, Marks & Spencer
Graham Bidstone, Meat Traders Federation
Will Lloyd Williams, Butcher and President Meat Traders Federation
Wyn Owen Nsch
Oliver Malloy

Belgium

European Parliament
Emma Greenow
Neil Parish, MEP
Jonathan Evans, MEP
Graham Meadows, Director General
Alwyn Strange
Wladyslaw Piskorz
Luca Marmo
Diaria Gismondi
Andrew Aggett
David Hemingway, NFU
Gerard Choplin, CPE

China

Angus Christian
Sarite Lee
Liang Angle
Millie Wu
Ling Sing Lee, L.C.S.B
Li Xiao Fei, L.C.S.B.
Chaminda Baddewthana, CAAC
Wu Lixuan, Governor Guzhen Town.
Heqing Chen, Director Dept Ag. Guandong Province
Michael Chen, CEO. Honmill International Ltd.
Jiuyuan Zhing
Sunny Chang, World of Flower Co Ltd.
Roger Zhang, SMH International, Shanghai
Yifang Zhang, Guangzhou Jiangnan Wolesale Market
Du Yaocheng Director General Zhongshan Foreign Affairs Bureau
Wang Qing Zhou, Shineway Group.
Deng Fu Jiang, China Meat Association
Lu Gangyi, China Agriculture Assn.
Gong Guifen, China Agriculture Assn.

Singapore

Poison Ivy Organic Farm and Restaurant

Australia

James Cutler, Primo Quality Meats, Scone.
Rob Kelly and Fiona, Guyra
Mathew Kelly, Guyra
Diana Perry, University of New England, Armidale
Sam Gill, Lambplan, University New England, Armidale
Ian Slacksmith, University of New England, Armidale
Andrew Mcpherson, Sastec
Michael Connors, Cargill Beef, Tamworth.
Doc Morrison, Gunnedah Saleyards
Bruce Walsh, Flemming and Ross Ltd. Gunnedah
Andrew Watson and Family and Heike, Boggabri.
McArthur Family, Oldfield Herefords, Gunnedah.
George Avendano, Grass Seed Grower, Boggabri
Mr & Mrs Peter Hall, Boggabri
Mark Humphreys, Boggabri Cotton Gin.
Garry Hannigan and Family, Broken Hill
Tracy Maddern and Family, Broken Hill
Leigh and Sue Vial & Family, Swan Hill
Andrew and Paul Nagorka & Family & Kylie
James Stewart, Elders, Hamilton
Theo Castricum, Castricum Bros.Ltd. Dandenong
Polkinghornes Quality Beef, Melbourne
Angus Christian & Family, Melbourne

Andrew Johnson, Tintinara
Liz Beckmann, Perth
Tracie Lefroy, Moora
Paul Fullwood, Freemantle
Dr Kelly Pearce, WAMCO International, Kattanning
Rob Davidson, WAMMCO International, Kattanning
Alan Manton
Dave Fullwood, Cunderdin
Slade Brockman, PGA
Mike Tempone, ABB
Nuwan Patabendige, Joe White Maltings Ltd.
David Capper, CBH Group.
Garry Robinson, Emanuels (live export)
George Basha, MLA
Jo Quigly, MLA
Tony and Amanda Barker & Family, Tasmania
Anthony and Gillian Brandsema & Family, Tasmania
Sarah Ackland, Tasmania

New Zealand

Geoff and Ailsa Neilson, Mosgiel
Graham and Sue Evans, Owaka
Vaughan and Megan Templeton & Family, Riverton
Neil Willis, Alliance, Lorneville
Andrew Welsh, Twin Farm Genetics, Riverton
Malcolm and Miriam Taylor, Ward
Sally and Peter at Isolation Merino, Ward
Mark Aspin, Pastoral Greenhouse Gas Research, Wellington
Rowan Ogg, Meat Industry Assn. Wellington
Craig Finch, Meat and Wool New Zealand, Wellington
Jeff Grant, Chairman, MWNZ, Wellington
Dr Andy Gray, MWNZ, Wellington
Ben O'Brian, MWNZ, Wellington
Federated Farmers
Holmes, Adrienne, and Michael Warren & Family, Masterton
Neil Smith, PPCS Richmond, Hastings
Stuart Taylor, PPCS Richmond, Hastings
Paul and Dr Jenny Nelson (neé Anderson), Taupo
The Roderick Family, Te Puke.
Barry Allison, Open Country, Waharoa.
Garry Kirby, National Bank, Morrinsville
Mike Fenton, MAF Quarantine Service, Aukland
Prof. Roy Bickerstaffe Lincoln University

Travelling Companions

Paul Baker
Mike Giffin
Fintan Grimes
Emma Hockridge
Geraint Hughes
Claire O'Keefe
Will Scale