Nuffield Farming Scholarships Trust

A John Oldacre Foundation Award

Adopting Modern Technologies

to

Increase Beef Production

Tim Powell

July 2011

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1. Executive Summary

At a time when experts are predicting a boom in demand for meat to feed the ever-increasing world population, it is generally expected that farmers should increase the efficiency of beef production in a sustainable and welfare friendly manner and any method should be used to achieve this. The tools that are most commonly available to do this are growth promoters and hormones as well as genetically modified (GM) crops. However these are banned in the UK because, as in the rest of the EU, they are generally deemed to be harmful.

British farmers are being unfairly treated. Farmers in other countries are permitted to use these tools which can make them more efficient as beef producers. Even more galling is the fact that the UK allows the import of meat from countries such as Argentina and Brazil, countries which are allowed to use growth promoters and hormones. The beef is imported into Ireland and then repackaged under the logo of 'Packed in the EU' before finding its way onto the British supermarket shelf.

Furthermore, the British government has imposed production standards on UK beef farmers in the form of red tape, traceability, ear tagging etc. While these processes are costly and time consuming, I believe that these processes make UK beef the safest in the world. The consumers can rest assured that the meat they eat is welfare friendly, traceable and 'harmless'. However, the same British government allows the import of beef that is not produced to the same standard.

The Nuffield experience gave me the opportunity to study beef farming in the USA and New Zealand in order to make comparisons with UK beef production. I asked whether growth promoters do actually present a cause for concern. Why can't we use growth promoters and hormones? As a country, does the UK need to re-introduce hormone use or stand firm and ensure that no beef enters our country from countries where hormones are used? A similar argument applies to genetically modified foods. Can genetically modified crops that are considered Frankenstein foods in the UK, actually be embraced as they are in America?

During the study, I visited many farms and research centres and discovered many interesting techniques and ideas which my report highlights.

2. Nuffield Student

My name is Tim Powell. I am a beef farmer from Shropshire and I farm 632 acres in partnership with my parents. I am a 'hands-on' farmer and my academic studies finished with a National Certificate in Dairying. I have little interest in technology, describing myself as a grafter. I consider the tools of my trade to be cattle; we have about 500 fatteners and it is our intention to increase them to 650. No particular breed is purchased; in fact we have the good, the bad and the ugly on the farm at present. However, by choice we would run Holstein cross bullocks as they can achieve heavy weights and there is no stipulation by the local abattoir to have them slaughtered pre-30 months. They are also very easy to handle, which is important as we only use family labour. Contractors are used to make grass silage and for arable operations.

It is our intention to fatten everything with produce grown on the farm and nothing except fertiliser is bought in. We use no minerals and protein. Will this attitude prove to be narrow-minded? I believe that a penny saved is a penny earned. All cattle are grazed over two summers before being fed grass silage and rolled corn.

In 2005, opportunities arose to purchase neighbouring farms and 180 acres of arable land with a pair of cottages were acquired. In 2006, a 132 acre dairy farm on the other boundary was bought. Dairying had ceased and so the unit was converted to beef. This is where I currently live and all units are farmed as one enterprise. Of course, while it is important to make a profit, I have always believed that the balance sheet has more bearing and I would rather have 500 cattle on the farm worth £1000 each and making £50 a head a year, than 250 cattle making £100. Cattle are a relatively liquid asset and give the farmer clout with the bank.

I have to admit that over the years I have become very focused, as I have had to be, but I am very aware that perhaps I should be looking 'beyond the box'. This study has taken me beyond this box and allowed me to explore an issue close to my heart. As a beef farmer, I just could not get my head around the fact that our own government is perceived to be stifling UK farmers with red tape and bureaucracy which is a disincentive to produce food when the global population is set to rocket and at a time when resources are also depleting. My findings have broadened my outlook and completely astounded me; I never thought that my mind-set would change so radically. Also, the seed for a new business, completely independent of farming, has been sown and is being explored.

The Nuffield experience has offered someone like me, with a narrow academic base, the opportunity to explore farming to a level that I never thought possible. I have rubbed shoulders with leaders of associations such as CLA, NFU, the Treasury, and Natural England who were all very keen to help an aspirational Nuffield scholar. I have shared and gained knowledge and information with deep thinking people, important academics and international grass-root farmers – an invaluable tool for my farming career; so many doors have been opened.

> ***"****You will learn more by listening to a doer than talking with a talker!"*
> Tim Powell

3. Introduction to my study tour

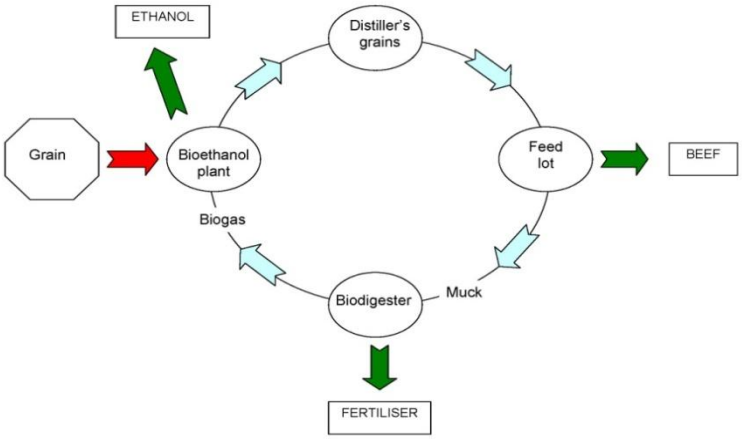
I applied for a Nuffield Scholarship in the hope that some questions would be answered regarding world-wide beef production and also to have a look at other aspects of modern farming including bio-digesters, bio-ethanol plants and feed lots: namely the 'closed loop system'. The Nuffield experience encouraged me, as a non-academic, to look deeper into the way I farm. I learned about the soil, ongoing scientific possibilities, genetics, economies of scale, and abattoirs. I realise that I have discovered nothing particularly new and ground-breaking but I found the study really interesting and have documented the highlights of my travel.

I decided to travel to the United States of America, the power house of the world; a country where GM crops are grown and hormones are used for fattening cattle; bio-ethanol plants and bio-digesters are being built; and where the mind-set is 'big is beautiful'. I also chose to go to New Zealand where pastoral beef fattening is practised. The practices used here are similar to those that are used on my farm but certain other procedures could be incorporated into the system. Nuffield also gave me the opportunity to visit beef farmers in the UK and to learn from their ideas.

So here is the detail of what I found.

4. The Closed Loop System

This is a very efficient system whereby grain is fed into a bio-ethanol plant to produce ethanol. However, the by-product is distiller's grains which can be fed to the cattle in the on-site feed lot. The manure from the feed lot then goes into a bio-digester to produce energy which in turn fuels the bio-ethanol plant. This is regarded as a perfect closed loop system.



4.1 Case study - Mead Cattle Company E3BioFuels, Mead, Nebraska

Manager: William 'Buck' Wehrbein

Mead Cattle Company, Nebraska, is a feedlot of 35,000 cattle adjacent to the bio-ethanol plant whereby waste distiller's grains from the bio-ethanol plant are fed to the cattle. A bio-digester is also adjacent and the muck from these cattle creates methane that provides electricity to run the bio-ethanol plant. This is called a closed loop system and is supposed to be ultra-efficient.

Buck Wehrbein was most welcoming and forthcoming with interesting detail about the closed loop system. He informed me that when corn prices are low and stable, the production of ethanol from this plant is profitable. However, in late 2007 when corn prices 'spiked' globally, the ethanol from this plant became uncompetitive and right across the United States bio-ethanol plants were shut down and those under construction were mothballed.

Regarding the bio-digester, I found that the smell from the cattle muck was almost unbearable and, because of that smell, serious consideration should be given before employing this method of creating electricity. The smell was even more prevalent when I visited Friona Industries Feedlot in Amarillo, Texas, where there are 85,000 cattle; the smell was noxious 20 minutes away from the site. At the very least they should be sited away from any housing conurbations.

Points of interest from this visit:

- Methane from cattle dung – an obnoxious smell.
- Closed loop systems are vulnerable to world economy
- The profit margin, even though the operation is on such a vast scale, is still surprisingly low – indeed if any profit is made at all

4.2 Bio-ethanol Production

Bio-ethanol is mainly produced by the sugar fermentation process. The main source of sugar required to produce ethanol comes from fuel or energy crops. These fuel crops are normally grown specifically for energy use and include maize, corn and wheat crops, waste straw and miscanthus, although there is also ongoing research and development into the use of solid wastes to produce ethanol fuel.

- Brazil and the United States account for over 70% of all ethanol production in the world today with the USA producing an estimated 6,500 million gallons a year.
- The waste products from burning Bio-ethanol are carbon dioxide and water. The carbon dioxide released during fermentation and combustion equals the amount removed from the atmosphere while the crop is growing.
- Each ton of wheat produces 336 litres of bio-ethanol

While visiting the US Meat Animal Research Center (USMARC), I learned that, in Nebraska alone, the processing of 16.8 million tons of corn produces five million tons of distiller's grains bi-product. However, there is evidence that the feeding of bio-ethanol bi-products contributes to increased emissions of odour, phosphorous and pathogens in the manure and USMARC scientists are currently investigating methods to reduce the environmental impacts of feeding bio-ethanol products to livestock. Vince Varel, Microbiologist at USDA, confirmed that "*As the concentration of wet distiller's grains increased in the diet, greater concentrations of nitrogen, phosphorous and sulphur appear in the manure".* Further research by Jim Wells and Elaine Berry, both at USDA, has shown that a greater amount of wet grains in a diet also affects the pH of the manure and therefore the amount of E-coli pathogens persisting.

4.3 Bio-digesters

Bio-digesters convert organic waste into a nutrient rich liquid fertiliser and a biogas. In a series of processes micro-organisms break down biodegradable material in the absence of oxygen. Bio-digesters help farmers by providing a cheap source of fuel, preventing pollution from runoff from animal pens and reducing diseases caused by the use of untreated manure as fertiliser.

Benefits:

- Provide clean and renewable energy
- Reduce greenhouse gas emissions, odours, pathogens and bacterial counts
- Convert waste into high quality organic fertiliser
- Convert crops i.e. wheat, maize and straw into energy

Disadvantages:

- Labour intensive as bio-digester needs regular feeding
- Effluent needs to be emptied daily
- Not suitable for colder climates unless it has separate heat generator

Having noted the above, it then made sense for me to investigate the use of bio-digesters and bio-ethanol plants within the beef and corn industry, and whether there was a practical use in the UK.

4.4 Bio-ethanol Production in the UK

Whilst the idea of a closed loop system is a sound one in principle, it can only operate efficiently when supplies of grain to the bio-ethanol plant are constant and can be purchased at a constant price. The last few years have seen extreme volatility in grain prices in the UK, from £180/ton in 2008 to £82/ton in 2009 and steadily rising again to its current level (July 2011) of £190/ton. Such extreme fluctuations have serious implications for the effective running of the closed loop system.

We should be very careful when taking the bio-ethanol route as volatility is a key word at the present time. We have seen this with the Ensus Bio-ethanol Plant, Yarm, near Middlesborough, which is the first bio-ethanol plant in the UK. It was opened in February 2010 at a cost of £250m. It was planned that the plant would produce 400 million litres of bio-ethanol and 350,000 tonnes of high-protein animal feed or dried distillers grain which would supply local farmers. At the time of commissioning, grain was £82/ton, making the system a viable and attractive option. However, grain prices rose to £130/ton in 2010 and rose even further in 2011 to £190/ton. In May 2011 a report in the UK farming press announced a four month closure of the Ensus plant from June 2011. While the report suggested that *'Managers of Europe's biggest wheat bio-refinery have cited falling demand, rising grain prices and growing competition from the US for the move.' (Ian Laing, The Journal, 14 May 2011).* In my opinion, the factory was closed for the simple reason that the grain is too expensive to feed into the plant. Furthermore, the local farmers, who were depending on the grain by-product, will have been let down as the supply of their feedstuff will dry up. They had taken a business decision to expand their businesses on the basis of a ready supply of quality cattle feed and are now exposed to buying in expensive alternatives. A lesson can be learned: not to rely on the by-product of this industry.

Our government has promoted the replacement of expensive crude oil with Ethanol for energy production, which they thought could be produced from

cheap grain. I believe that they have got it wrong. The supply of grain globally has fallen due to extreme weather patterns, for example very wet seasons in USA and Canada and dry arid conditions in Russia in 2009/10. This has caused sharp increases in grain prices thus making ethanol production very expensive and much less attractive.

A similar lesson should be learned relating to bio-digesters. It will not be competitive to feed maize and grain to produce methane. I think bio-digesters could become a complete white elephant and anyone thinking of building one should consider very carefully before making any big investment. The government, having taken advice from self-confessed experts who have no comprehension of external market forces and natural weather patterns, seems hell-bent on creating fuel and methane energy sources.

That said, there has still been a rapid promotion of bio-digesters in the UK. Local authorities are very keen to pass planning applications and, to a degree, there is euphoria about promoting these alternative energy sources to meet EU targets. I am aware of an instance where a bio-digester has been granted permission and is currently being built in order to receive maize to be harvested in autumn 2011. But, will supplier farmers forego the high price of wheat to provide maize for this bio-digester? I just wonder if, at the planning stage two years ago, the businessman concerned had expected grain to be so expensive today.

5. Calf to carcass

I learned that in the 1950s there were 97 million beef cattle in USA which rose to 133 million in the 1970s and has since fallen back to 97 million today. Total meat production remained at approximately the same level throughout this period, so efficiency has greatly improved and nearly 40 million cattle have been taken out of the system.

This has produced over-capacity in the feedlots which can be part of the reason for very poor profit margins from these feed lots as the fixed costs of running them have remained high. To offset this, latterly, some of the feedlots do not actually own the cattle but foster them and the feed costs are attributed back to the farmer/owner of the cattle. The feedlot owner can therefore make some additional profit through the sale of feed to the owner.

Calves are produced on ranches in areas unsuitable for corn growing. The calves are then weaned and sent to a feedlot in a corn-growing area. Calves can be shipped half-way across America. An example of this is calves born in Nebraska, Oklahoma and Ohio being moved to Texas for fattening.

5.1 Case study: Waunita Ranch, Imperial, Nebraska

Senior partner - Jack Maddux

Jack Maddux is deemed to be the most respected cattle rancher/ agriculturist/businessman in the area. He owns 30,000 acres of deeded land and also rents 10,000 acres. He grows about 2,000 acres of corn (maize) which used to be fed to cattle in his feedlot but because the price is so high he now sells onto the open market. Most of the land is native range (Great Plains) where he runs suckler cows. He also has a feedlot that can hold 3,000 cattle but he is now ceasing to fatten cattle in this feedlot because:

- the corn is too expensive
- economies of scale: he cannot compete with the bigger feeders in the area
- considerable re-investment is needed to update the feedlot
- environmental factors: his feedlot is adjacent to a stream that has flooded in recent years; he has concerns that effluent from the feedlot will leach into the water course.

Recently, Jack has been concerned about global warming and indeed, a severe drought in the early 2000s affected his decisions. As a result, in 2005, the US government offered a scheme to depopulate the plains in drought stricken areas. Any taxation due on the proceeds of herd disposal was temporarily waived. Jack sold all the suckler cows as insufficient fodder was available to feed them. As a caveat, the government insisted that in order to avoid paying tax on this dispersal, the herd would have to be reintroduced within five years.

5.1.1 Composite cattle breeding

The Maddux family is now reinstating the suckler herd to avoid paying this tax. John, the son, believes that the best way forward is with a composite breed – that is a breed which is deemed to be most suitable for the natural environment. The breed of cattle that he is introducing is an all-Red breed:

- 1/8 Tarentaise
- 1/8 South Devon
- ½ Red Angus
- 1/8 Red Poll
- 1/8 Red Devon

Photo : composite cattle breed awaiting administration of PRIDs Location: Waunita Ranch, USA

He has chosen this composite breed purely for management purposes: composites are designed for low input systems with year round grazing. Little or no stored feeds or supplements are needed. He believes this cross breed also has 20% more heteorosis (hybrid vigour) so that newborn calves are faster to be up and away. These animals are moderately sized and are self sufficient, being able to look after themselves on grazing, and they also have convenience traits of easy calving, good docility and fertility together with good udders and teats.

5.1.2 Calf Production

The Madduxes are building up numbers to approximately 2,500 calving composite females, block calving in March. Whilst I was there, I assisted the staff in synchronization of oestrous. 580 bulling heifers had Ceders inserted (equivalent to PRIDs - Progesterone Releasing Intra-vaginal Devices) which were removed 12 days later. The heifers are then artificially inseminated once and the natural bulls are run with them. Calving occurs in March and the following autumn these calves are weaned and some of them sent to other feedlots. Previously, the males would have been fattened in their own feedlot, but are now sold off. The heifer calves, now planned to enter the herd the following year, are fed on corn stocks (the residue from maize harvesting) along with the dry cows.

Dry cows block calve in March. When 10% of their number has calved, the remaining 90% of dry cows are shifted to a new pasture so that any

scouring calves keep their problems to themselves. This concept is interesting as in the UK we generally remove the cows and newly born calves from the shed and leave the pregnant cows to calve in the potentially contaminated shed.

Whilst the plan was and still is to expand numbers to 2,500, during my visit the price of cow/calf units rose to US$1300 and Jack took the opportunity to sell a few of the units. Jack's philosophy is that a good businessman must be flexible and opportunist. As the environment around them has changed, this family has always been at the forefront of adaption and has been flexible in moving with the times and conditions. I have learned something from their methodology and mindset. Whilst they are still making their money with cattle, they have completely evolved and have not only modified their suckler breed but also the system and outlook.

The Madduxes and their staff of five men work extremely well together as a team. This is how they have become so successful. I asked Jack if people ever got jealous of his success. He responded:

"Well, we tryta kinda be humble ya know!"

And he certainly was! Wherever I went throughout Nebraska, Jack was known and revered.

Points of interest from this visit:

- Be flexible in your outlook to your farming method
- Treat your staff as team members and with respect – it will pay dividends.

5.2 Feedlots

During my study trip to America, I visited numerous feedlots, ranging from the smaller family units feeding 2,000-3,000 cattle, such as Jack Maddux in the previous case study, to the largest in Texas raising 85,000 cattle, with a typical feedlot size fattening around 5,000 cattle.

5.2.1 Case study - Harry Knobbe Feedyards, West Point, Nebraska

The Knobbe family runs a very successful feedlot of 5,000 fattening cattle. The feedlot operates slightly differently to others in that

- Cattle are fattened at Knobbe feedlot but are still owned by ranchers
- Cattle are bought in by Knobbe and fattened before being sold for slaughter

- Knobbe can act as a cattle agent: cattle can be bought in by Knobbes and immediately sold to other feedlots without fattening

Newly purchased cattle are vaccinated against BVD and pneumonia and are wormed with Cydectin. They are also administered growth promoters – Tylan - and are fed food with Romensin. The diet on which they are fed consists of:

- 39% rolled maize
- 25% distillers grains
- 22% maize silage
- 10% sweet bran
- 3% supplements (soya bean pellets, minerals)
- 1% hay (roughage)

They are expected to put on 3.7 – 4 lbs per day Live Weight Gain (LWG) in summer and 3 lbs per day in winter. The conversion rate is expected to be 7:1 if growth promoters are used and 7.75:1 if they are not used. So effectively, efficiency increases by 10% if growth promoters are used.

A beast purchased on 31.12.09 at 805 lbs had reached a weight of 1375 lbs on 16.6.10, the day I visited, which was the day it was slaughtered. Thus a LWG of 3.2 lbs per day had been achieved. Most cattle remain in the feedlot for between 140 and 150 days.

As in the UK, pneumonia can be a big problem, especially with calves weaned straight off the cow and having travelled across several States to this feedlot. Vigilance must be maintained, but even so a mortality rate of 0.7% is still expected. Newly introduced weaned calves are fed hay in their ration for the first few weeks and grain is introduced slowly so as not to cause digestive upsets which can induce pneumonia. These calves can also be problematic to train to drink water from a trough as they have only ever sucked the teat.

Because most of the cattle are housed out of doors, in extreme weather conditions mortality can exceed expectations.

I was most surprised to learn that if a beast made $10 profit during its stay, it had done well and not necessarily the norm; the margins are razor thin, even in a big feedlot.

Photo: Knobbe Feedlot

Points of interest from this visit:

- Growth promoters are a tool to increase fattening efficiency – without them this feedlot would be operating at a loss.
- The profit margins are razor thin. Big is obviously not always beautiful. You can certainly burn some money when things go against you and a small rise in corn prices can be the difference between profit and loss.

5.2.2 Case study – Friona Industries Feedlot, Amarillo, Texas

Manager – Del Volmer

Friona Industries has 85,000 cattle in one feedlot. Mr Del Volmer, manager of Friona Industries, showed me around. The thing that stood out from this visit was that economies of scale did not necessarily make that much difference to the bottom line and, in recent years, profit margins had been squeezed as explained below.

Photo: Feed processing plant, Friona Ind.

Photo: Cattle at Friona Feedlot

The smaller feedlots have become uncompetitive and many are planning to close down (including the Maddux family already mentioned, see para 5.1) citing increased regulation coupled with prospective water pollution issues, leaving the larger ones to produce the beef. However, in some instances, only US$1 profit per beast is being made.

I questioned why, for such a small margin, they should keep the feedlots full while sometimes operating at a loss. Mr Volmer explained that the total fixed costs were the same no matter how many animals they had, so the fixed cost per beast was lower the more they had. It seems to me that even on a scale of that size, the beef producers are still price takers not price makers, which was a surprise.

This has got me thinking regarding my own business; I can only thrive when I am either a price maker or conversely have full control of my costs. A lesson can be learned that if you have no control of your costs, as I have mentioned with the wet distillers grains from the Bio-ethanol plants, and also have no control of the price that you accept for your end product, you are sitting in a very vulnerable position.

6. Tools of Efficiency

As a young man growing up in the early seventies, I can remember using the growth promoter Finaplex on our barren cows. These were little prills injected into the ear of the cow and were used as a tool for efficient fattening of the cow. However, the EU Government at the time decided to ban them saying that they were unsafe and it has been so ever since; UK farmers have not been able to use growth promoters or hormones.

Things have moved on and, in recent years, we have been importing a lot of beef, some of which I believe has come from Argentina and Brazil where these promoters are common place. How can we compete? Doesn't it seem hypocritical that we have been importing meat through the back door from countries where promoters are being used?

I am interested to discover whether or not we can use them in the UK and indeed, whether we *should* use them. I set about getting some background information to clarify the position.

6.1 Hormones and Growth Promotants

In America growth hormones and steroids have been used for nearly 60 years to help cattle convert their feed efficiently into more lean muscle. These include oestrogens (estradiol and zeranol), androgens (testosterone and trenbolone acetate or TBA) and progestins (progesterone and melengestrol acetate or MGA).

Currently there are 30 growth promoting products marketed in the United States. Calves entering a feedlot, having been wormed with Cydectin and weighed, are given growth promoters to enhance muscle development. Tylan-Romensin is also applied to the dry feed ration and a conversion rate of 7:1 would be expected. For example, for every 7kg of dry feed, a live weight gain of 1kg could be achieved. If no promoters are used then this conversion rate rises to 7.75:1. It therefore follows that food efficiency has improved by 10%.

The growth promotant used is also proven to improve lean tissue from 12% when *not* treated to 20% *when* treated. Steers implanted with a growth promotant gained weight at about the same rate as a bull. Implanted animals will have metabolised the hormones before being slaughtered and no traces should be found in the meat.

A University of Minnesota Extension Service Study found that this efficiency increased annual US beef production by more than 300,000,000 kilos and saved 2.5 billion kilos of feed. In addition, using the beef production practices from the 1950s, when no promotants were used, 165 million more acres of land (an area almost the size of Texas) would have to be used. Therefore, it follows that this increased efficiency has released considerable acreage to produce grain to feed the growing population.

Government agencies enforce stringent criteria to ensure animal health and human food safety. In fact more than 500 different USDA studies have been conducted; they have deemed that cattle reared with promoters are absolutely safe for consumption. Indeed, I asked several different people on my travels, including Dr Galen Erickson from the University of Nebraska in Lincoln, for their opinion. Dr Erickson concluded that they were perfectly safe as the dose of hormone used was miniscule: 'A blade of grass on a football field', he retorted. In some cases, when a heifer was implanted with oestrogens, this would serve to stop her from coming on heat and indeed when the meat was analysed, there were fewer oestrogens in the meat than there would have been had she not been implanted. A mature cow, having had several calves would indeed have thousands times more hormone in her meat than a barren heifer.

Dr Erikson also said that the oestrogens in other foodstuffs such as cabbage, kale, broccoli, milk and ice-cream were a thousand times greater per pound than in hormone treated beef.

Another interesting fact Dr Erickson produced was that because of increased efficiency, more beef could be produced off less land, producing less greenhouse gas per pound of meat, thereby reducing the carbon footprint.

It seems that we have got it wrong in the UK and we are missing a trick. However, investigating on the internet I found that a study by Dr Young C Lin (http://www.annieappleseedproject.org/catgrowhorbr.html) has reported that the beef growth promoter zeranol , an endocrine disruptor, increases oestrogen production in breast fat cells. Concerns have been raised that it may be a possible contributor to an increased incidence of human breast cancer. During my travels, I questioned several experts about this issue and they commented that it was life-style and obesity and not growth promoters that were responsible for breast cancer. I came away none the wiser but felt very enlightened by hearing both sides of the argument.

See http://www.aphroditewomenshealth.com/news/20020909195043_health_news.shtml
I recognise that improvements in cattle production technologies including the use of growth promotants have helped provide the growing population with lean beef whilst using fewer resources; they improve growth rates and feed conversion efficiency, and cattle typically improve lean tissue by between 8% and 20% compared to non-treated cattle.

Everyone I spoke to commented that there was no scientific evidence to support a ban on the growth promoters and that they were banned for political reasons, not scientific ones. It is my opinion that they have been banned to protect the European beef industry. If we were allowed to use them, we would have no excuse for banning the imported meat from the USA which would then flood our market.

6.1.1 Progesterone

In both America and New Zealand, I found that progesterone (the hormone of pregnancy) was used as a tool to enhance value. In the suckler herds and dairy herds in both countries, cows were put in calf

on purpose, even if they were destined for the abattoir before they were due to give birth. It has always been known that pregnant animals convert food to meat at a better rate than non-pregnant ones and so fatten more quickly.

In an abattoir in the USA, I witnessed the slaughter of many of these cows. The unborn calf from the carcass, after evisceration, was then sidelined. The skin and blood were clinically removed and both were used for medical science: the blood for cancer research and the skin for human skin grafting. The procedures were carried out very matter-of-factly. Whether or not the general public has any awareness of these issues is unknown to me but I thought the procedure was certainly thought provoking if not abhorrent. If it happened in this country I believe the public would be up in arms, meat sales would certainly drop and the image of the industry would be damaged. I mentioned my personal views to those concerned to be met with the response "Well...you in the UK benefit the same as we do from the research using these products."

In New Zealand, heifers were put in calf and selected when they were very close to calving, slaughtered, and the foetal blood was removed and diverted to Japan for research. The meat from the mother was also used as beef but was almost seen as a bi-product; the blood being the most sought after.

6.2 Genetics of Beef Production

One of the most interesting observations of beef farming both in the UK and in the USA and to a lesser degree in New Zealand, is how farmers are trying to create a more manageable animal (see para 5.1 Jack Maddux case study).

Over the past 30 years, the introduction of Limousin, Charolais and Blonde Aquitaine cross breeding to create a better carcass, has also created somewhat psychotic animals that are difficult and dangerous to handle. This has become more apparent of late with the introduction of belly clipping and the perpetual hassle of TB testing. Both procedures cause me considerable stress. These cross-breeds are also more expensive to grain-fatten than the native breeds that fatten more efficiently on grass. As the average age of farmers in the UK increases, we are recognising that, for our own physical safety we should breed quieter animals that are easier to manage or, at least, employ better management systems and have a better understanding of animal psychology.

I am aware that research is taking place in these fields, so as part of my trip I wanted to investigate what was being done to alleviate these problems. I am also aware that the United States Department of Agriculture (USDA) research centres are doing extensive work on genomics.

6.2.1 Case study - US Meat Animal Research Center (USMARC), Clay Center, Nebraska

Research Leader – Dr Harvey Freetly
http://www.ars.usda.gov/pandp/people/people.htm?personid=1841

The United States is extremely supportive of farming and it has considerable funds available for agricultural research and development. In 2009, the USDA contributed to publishing the DNA sequence of cattle which recognises 50,000 genetic markers. These markers are spread evenly across the cattle chromosomes to allow identification of genetic differences wherever they occur. As new DNA marker technology becomes available, traits such as feed intake, carcass traits, meat quality, growth and disease resistance will be identified. Similarly, the identification of docility and wildness genes can be isolated and indeed removed and subsequently replaced, thus creating a much more docile fattening animal.

Currently, research programmes are using a female breeding population of 6,500 cattle comprising 18 different breeds. While visiting USMARC, I spoke to Dr Harvey Freetly about the work that was being done. There are 50 scientists employed at the centre, studying a myriad of genetic issues, of which I found DNA testing to be particularly interesting.

Dr Freetly also explained to me that trials on feed efficiency are being conducted: that means the efficiency with which animals convert nutrients in feed to meat whilst decreasing the environmental impact of meat production. Animals vary in their efficiency of food utilisation. Scientists are using new technologies to identify efficient animals and identify genomic markers responsible for he natural variation in rates of growth and feed intake.

I found the most interesting studies at USMARC to be:

- The isolation of various genes, for example, the “wildness” gene in Limousin cattle, which could then be replaced with a docile gene such as that in the South Devon, to create a quieter beast.

- How feeding and nutrition of pregnant cows will affect the FUTURE efficiency and fertility of unborn calves.

- How nutrition during puberty affects the longevity of that beast.

- Twinning trials: a cow that is a twin is mated with a bull that is a twin and any cow that produces a set of twins is used for further mating. Only animals from multiple births are used on this trial and it is hoped that an obvious genetic marker on the DNA is located for twinning. This trial has been thwarted because, as we know, a heifer calf born twin to a bull calf will be infertile. Only a heifer calf

twin to a heifer calf can be used for this trial. This occurs in only 1 out of 4 twin births, so the trial proceeds very slowly.

It is very encouraging to learn that research is being carried out in the US which benefits the global beef industry at a time when research and development in the UK has been run down.

6.3 Animal Behaviour

To complement the scientific research into animal temperament, I flew to Denver, Colorado where I had a meeting with Mark Deesing, Animal Psychologist and Behaviourist and designer of cattle handling systems at Colorado State University. Mark is a world leading researcher in animal behaviour and has worked extensively with Dr Temple Grandin for many years. I was highly privileged to be afforded time with Mark to learn about his research. I was given an insight into cattle handling systems and the passive flow of the animal into the slaughterhouse. In his research, Mark Deesing has also highlighted that the genetic make-up of an animal could have a marked effect on both its temperament and feed efficiency.

During my visit to Mark's ranch, I discovered that some very simple cattle handling techniques can greatly reduce the stress of both the animal and the farmer.

"Animals with a fine-boned skeleton, little fat and a slender long body often have a highly reactive temperament and are frequently more flighty than animals that are large boned, stocky and heavy set. A gene make-up that encodes an animal's body to grow to be large and stocky, regardless of breed, will also often produce an animal that is calm and is less likely to panic".

"It is important for producers wanting to deliver high quality meat to their buyers to select for temperament. In auctions and abattoirs, cattle that become highly agitated are dangerous and are more likely to have dark cutting meat. Long term stress pre-slaughter depletes the energy stores in the meat and may cause it to darken".

Ref: Humane Livestock Handling *by Temple Grandin and Mark Deesing*

6.4 Genetically Modified Crop Technology

Having travelled to the USA it seemed a pity not to gain further understanding of the use of genetically modified (GM) crops to produce grain efficiently to feed the cattle. I made an appointment to visit the Monsanto Center in St Louis, Missouri.

6.4.1 Case study – Monsanto Center, St Louis, Missouri

Soya Bean Project Manager – Kimberley Magin Sutter

Monsanto's glossy brochure begins with the words: *(see next page)*

"The facts are simple and sobering. By the year 2050, humanity will need to double the amount of food produced in the world to meet the demands of the growing population".

This is a very bold statement which, in my opinion, is not entirely true. I believe that the argument about physically feeding the growing population with food is to a degree slightly flawed and, even at the present time and for the foreseeable future, there is enough food to feed the world. The biggest problem is that half the world is starving whilst the other half is wasting enough to feed them. Undoubtedly, modern technology and bio-chemistry will have to be used for the production of grain, but more so for animal feed, which is in turn converted to meat. Global meat demand is projected to reach 376 million tons by 2030.

I was very privileged to have spoken with Kimberly Magin Sutter who said that biotechnology was the major tool for moving forwards. She affirmed Monsanto's commitment to sustainable farming with expectations to double yields of corn and other crops, achievable through speeding up seed breeding changes whilst verifying safety to humans.

In the USA, corn yields are 6 times greater today than they were 60 years ago, mainly due to technological development and greater use of resources such as fertilisers. But for the next 60 years, the rate of these advancements will be much slower, so the yield from the seed must be a major contributory factor. It was explained to me that through Monsanto's work in seed breeding, the company aims to produce superior genetics that allow farmers to get more out of the seed. Also, enhancement will be made by inserting genes into the seed to create a bio-technology trait; this will provide a way to combat insects and control weeds and also improve crop tolerance to heat and drought.

In the pipe-line is *Genuity SmartStax corn.* It is an all-in-one corn trait platform which combines eight different genes for above- and below-ground insect protection and herbicide tolerance.

Also in development is a drought tolerant seed which works by counteracting the dearth of soil moisture content on the plant physiology. Briefly, in drought conditions, plants begin to shut down their metabolism which slows photosynthesis and growth. The gene that Monsanto has isolated enables the corn to maintain its metabolism for a longer time during drought stress.

Ref: Monsanto Annual Report 2009 – Growing Together

Similarly, *Genuity Roundup Ready 2 Yield* soybeans were developed through gene mapping. This means that soya beans are resistant to Roundup; the whole field can be blanket sprayed with Roundup which is a herbicide that destroys any plant that has foliage. Roundup has been widely available for many years and patents are coming off, making it a very affordable spray.

In Nebraska, I rode on the back of a sprayer while the farmer, Mr Bart Ruth, was spraying his soya beans with Roundup. The sprayer had a GPS computer which recognised any overlapping where the crop had already been sprayed and all or part of the boom was switched off. This looked to be very efficient, and I was told all the foliage, weeds, etc except the soya bean itself, would be destroyed.

I questioned Bart as to what would happen if some of the soya bean seeds entangled themselves in the fur of an animal or were eaten by birds and then dropped in a field several hundred metres away, destined to be planted with a different crop the following season. In this scenario this field would be sprayed in the following spring with Roundup to remove any weedy foliage before planting with maize. The soil would then be min-till (the surface lightly worked down) and planted with this maize. However this soya bean seedling would not have been destroyed and would be a pest in the wrong place.

There is obviously room for more research. Bart suggested that a new product would have to be designed to address such a situation. It appears that whilst addressing one problem, another is created.

Furthermore, when I spoke to several farming leaders, I questioned them as to whether the use of Roundup could be storing up future problems. Further research led me to a report by Professor Don Huber a senior scientist at Purdue University: http://farmandranchfreedom.org/gmo-miscarriages This article should be read by anyone who believes that unanswered questions remain about the widespread use of chemicals.

Regarding Genuity SmartStax corn, genes are taken from a plant that is poisonous to some insects and injected into a food crop plant. When an insect nibbles on this plant it is killed. By the same reckoning, by killing this insect, are we removing the food source of something further up the food chain and so it goes on? We are disrupting the whole cycle of life which will have long lasting effects on our eco-system.

Having been disappointed that the EU is being over cautionary in its approach to letting UK farmers use GM seeds, I can now quite understand why, because it is too early in the day to recognise what could go wrong. There is no turning back once the *gene* is out of the bottle. That said, I cannot be so naive as to think that these GM seeds do not have a place somewhere in the world. If we take the moral high ground, which I think is questionable anyway, and set about feeding the extra three billion people, drought resistant seeds would definitely play a part in arid countries.

6.5 Soil Analysis

Without exception, a common factor in the success of the farming operation of every farm I visited, whether in the UK, America or New Zealand, was that a comprehensive soil analysis had been conducted. This highlighted the fact that for many years, in my business, I had only ever bothered with this process when I re-seeded a grass ley. This is totally inefficient as I have

not discovered the nutrient base of the soil and the help it would need to produce a better crop. The escalating price of fertilisers should inspire farmers to employ soil analysis to ensure the correct elements are delivered to enhance production and reduce unnecessary cost.

Plants need nutrients to grow and any deficit will cause a compromise in crop development and poor production will result. A simple and cheap soil test will reveal the medium in which plants are expected to grow. For optimum plant development, whatever the crop, the soil in which it is grown has to have several optimal attributes:

- **PH (acidity):** The optimum PH should be between 6 and 6.5. Maintaining the correct degree of soil acidity helps grassland productivity by ensuring better soil bacterial and earthworm activity, optimising nutrient uptake. Anything lower would result in acidic soil, compromising growth, but it can be easily rectified by the use of lime. This should be done by spreading 2.4t per hectare (2.5 acres) per application, which will raise PH by 0.2 units. No more than 5t of lime per hectare should be spread in any one season and it will take 9-12 months to notice the increase in PH

- **P (Phosphate):** Phosphate is essential for root development which provides anchorage for the plant, drought tolerance, plus it allows sufficient uptake of nitrogen. The optimum target is an index of 2-3. It should be noted that if PH is lower than 5.5 or greater than 6.5, phosphates are locked up.

- **K (Potassium):** essential to transport nutrients around the plant. Optimum level again is 2-3.

- **Magnesium and Sodium**: Reasonable levels of both should be maintained alongside Potash to safeguard grass palatability. Magnesium is essential to reduce the risk of grass staggers in grazing animals.

- **Nitrogen**: Essential for grass production. The level of fertilizer required by grassland depends on its nitrogen supply status.

Phosphate and potash recommendations for grazed swards:

Soil P or K status				
	0	1	2	Over 2
Dressing required (kg/ha)				
Phosphate	60	40	20	0
Potash	60	30	0	0

Phosphate and Potash recommendations for cut swards: *(see next page)*

Phosphate and Potash recommendations for cut swards:

Soil P or K status					
Y7	0	1	2	3	Over 3
Dressing required (kg/ha)					
First cut silage					
Phosphate	90	65	40	20	0
Potash					
- previous autumn	60	30	0	0	0
- spring	80	80	60-80	30	0
Subsequent silage cuts					
Phosphate cut 2	25	25	25	20	0
Phosphate cut 3	15	15	15	0	0
Potash cut 2	120	100	60-90	40	0
Potash cut 3	80	80	40-80	20	0

**Source Fertiliser Recommendations for Agricultural and Horticultural crops RB209 Stationery Office London*

- The direct return of P and K through defecation means grazing depletes soil reserves relatively slowly, whereas three or four silage cuts can remove 90kg/ha of phosphate and 300kg/ha of potash.

- Generally speaking 0.5kg of phosphate and 0.5kg of potash per hectare should be applied for every kilo of Nitrogen used.

- Cattle FYM (25%DM) would provide 2.1kg per tonne phosphate and 4.8kg per tonne potash as available nutrient.

- Slurry would provide 0.6kg per tonne phosphate and 3.2kg per tonne potash available nutrient.

- Sandy soils have little reserves of potash but heavier clay soils can provide 2/3 of annual crop requirement.

In addition, get a spade out and dig a few test holes to check on the soil compaction. This is where soil has been squashed into a solid impermeable layer either at the surface or within the top soil. This restricts the movement of air, water and nutrients down through the soil profile. If water lies trapped in the soil, the organic matter cannot be broken down.

The most efficient farmers, both in the UK and abroad, have all made mention of the fact they have their soil analysed every three to four years. It seems most important that with rising fertiliser prices we should all learn from them.

7. Abattoirs

7.1 Case Study - Cargill Meat Solutions, Schuyler, Nebraska

Manager – Mr Christian Perversi

I was very lucky to be able to visit this abattoir, because as you would expect, security was stringent. This facility is an under-30-months slaughterhouse. Each day, 4,800 cattle are processed, which works out at 350 an hour and represents 1.2 million cattle a year, most of which are from Nebraska and South Dakota. The processed beef finds its way to local retail grocery stores, but if the beast is under 21 months of age, some of it is destined for the Japanese market.

The plant opens for processing at 0600 hours when 1,200 cattle are already waiting in the lairage. Nearly all of these are Black Angus cross, weighing between 1100 and 1375 lbs. During hot weather, a spray / sprinkler system sprays water over the pens to keep the animals cool. They are then driven into various chutes where finally, in the 'kill chute', they are conveyed to the kill box with the assistance of a conveyor belt that elevates them off their feet and transports them forward in a continuous flow. A slaughterman then shoots the animal with an air-compression captive bolt and it falls sideways before being hoisted by back leg shackles to be bled. The carcass is washed with power washing facilities to alleviate any dirtiness on feed lot cattle. This surprised me because some of the cattle were caked in muck but still they were washed *post mortem.*

After evisceration and tying of the rectum, the animal is skinned and the carcass split; each half of the carcass is marked / dyed with the letter J if the animal is suitable for the Japanese market. The meat is scanned electronically and the side is then split between the 12th and 13th rib so that the profile of the meat could be visually inspected for marbling, meat quality and grading. The carcass then goes down the processing line and the animal ends up in relevant shrink wrapped packages having been steam pasteurised and subject to three acid rinses (two lactic acid and one peroxiacidic acid) to inhibit bacterial growth. The whole process takes 1hour 10mins from slaughter to final packaging but it must be remembered that after slaughter and siding of the carcass (which takes 20mins) the carcass is left to hang for a day before processing.

Points of interest from this visit:
Generally speaking, Cargill Meat Solutions can teach us something about an efficient meat processing company, namely that there is a smooth transition through the slaughter line from lairage to processing. Great attention was paid to recycling, with 44.6 million gallons of waste water and over 15,000 tons of compost supplied and spread free to local farmers.

7.2 Case study - Dakota Premium Foods

Plant Manager – Steve Cortinas

Dakota Premium Foods operates on very similar lines to Cargill Meat Solutions but processes over 30 month old cattle. The animals are killed in a kosher fashion.

Photo: A beast pre-evisceration
Courtesy of Steve Cortinas, Dakota

7.3 Case study -The Mhong Abattoir, Minneapolis, Minnesota

This was a very small slaughter outfit that catered for the needs of the Mhong race of people. This is a race of people that has been harassed in China and have consequently settled in the United States. The Mhongs have brought their religious beliefs with them.

When an elderly person dies, a funeral service lasting three days ensues because the Mhongs believe it takes this amount of time to travel from one world to the next. Along this transition journey they believe that an animal's eyes and feet are required to assist them. In modern abattoirs, these are not available to the general public so the Mhong have to slaughter animals in their own fashion. It is believed that when an elderly lady dies, her child should 'sacrifice' a beast and his/her spouse should provide a goat, sheep or pig, and each grandchild, a chicken. In the lairage I have never seen such a mixed bunch of animals awaiting slaughter. It was not the meat that was of paramount importance but the head and feet.

I ventured into the slaughterhouse itself and whilst conditions looked relatively clean, the facilities were nothing like the previous two I had seen. Without saying anything more, I fully accept that this race of people should be allowed to pursue their own slaughter rituals. It is their belief and we should not poke our nose in or interfere with their way of life.

See photo of Mhong Abattoir on next page

Photo: Motley bunch of animals in the lairage at the Mhong Abattoir

8. Beef Farming in New Zealand

Having been to the United States to witness very intensive beef fattening units where animals were fattened purely on grain based products, I then wished to see a complete contrast. So I travelled to New Zealand, where I knew the beef cattle were largely fed on grass. These cattle are often 95% chemically lean (compared to USA cattle at 50% lean). Only about 10% have been treated with growth promoters and these carcasses end up in American or Asian markets.

8.1 Cattle Breeding and Rearing

Most of the beef cattle are entire bulls originating from the dairy herd and born within a short season as block calving is prevalent. They are mainly Jersey cross New Zealand Friesian, so they are much smaller and generally of poorer type. They are purely a bi-product of the dairy herd and beef is certainly not a priority, as the focus of the dairy farmer is his dairy heifer replacement.

Calves are predominately born from the middle of July onwards until September which of course is their late winter period. There is a very hard selection process regarding bull calves taken on for fattening. Exceptionally poor quality calves are shot at birth and anything that has only the slightest bit of meat goes straight to slaughter as what is called a Bobby Calf. These calves must be a minimum of four days old and must have been fed colostrum (containing anti-bodies). When the calving season begins, substantial numbers of calves are born daily and the colostrum from their mothers is collated with any surplus being sold to the calf rearing units every two days.

Concentrated colostrum is only present in the first milking after calving. It contains more fats, proteins, minerals and vitamins and also, more importantly, antibodies which can only be assimilated by a calf within its first 24 hours. These antibodies offer some protection against pathogens such as rotavirus (provided the donating cow has been vaccinated). Maternal antibodies are not transported across the placenta and calves are born with a very immature immune system and no resistance to disease. Immunity is transferred from cow to calf through immunoglobulin in colostrum. Mark Bocock (*see 8.1.1.)* reckoned that calves without sufficient immunity are four times more likely to die than those that have had adequate colostrum.

In fact colostrum is recognised by calf rearers to be such a valuable food for the first few days that they compete with each other to source it; it proves to be an added value item to the dairy farmer who is able to sell it.

8.1.1 Case Study – Mark & Michelle Bocock (3,500 Head Calf Rearing Unit)

Mark and Michelle source their calves from a limited number of dairy farmers in order to reduce the disease risk attached to buying in calves from numerous sources. All calves are tagged with E.I.D electronic identification tags. On entering the unit, they are batched up and fed on a simulated teat twice a day for the first week. They are carefully monitored to ensure they are all keen suckers. Any slow feeders are identified and are grouped together accordingly. Colostrum is purchased in bulk from local farmers for about 25 cents per litre. This is mixed with milk powder costing 55 cents per litre. This obviously means a big saving. Formic Acid is added to the Colostrum to act as a preservative. Pelleted food is immediately added on an ad lib basis. Calves are bedded on woodchip which is cheaper than straw and free draining. I mentioned that I had been to visit a big dairy unit in the United States where sand was used as bedding as it was non pathogenic and was less likely to contain disease. I asked if it was used throughout New Zealand. Mark said that he hadn't even heard of the idea and would look into it later in the week.

The calves are then moved to a series of pens which surround a small courtyard and once a day each pen of about 50 calves is let into this courtyard to suckle on a 60 teat feeder. This enables each batch of calves to be studied independently and any lethargic or sickly calves are soon noticed. The teat feeder operates on a hoist and when the calves have finished suckling it is lifted vertically upwards and dogs then herd the calves back to their enclosure. Calves are weaned at about 6-7 weeks by which time they have typically drunk about 155 litres of milk each. Because space is at a premium, many batches of calves are reared outside (up to 2,500 at a time), but the same principle applies.

Following weaning at 6-7 weeks, the calves are eating 1 kilo of 20% protein pellets a day. At this time they are introduced in bunches of 200 to a paddock and concentrates are increased to 1.5 kilos per day for the next two weeks. This is then reduced gradually down to half a kilo by week 12. Calves are then kept on this regime until sold to farmers intending to graze them on until slaughter. Mark and Michelle aim to make NZ$50 profit before tax per calf.

Artificial teat feeders at the Bocock's calf rearing unit

Dehorning calf crate holding two calves between padded gates

8.2 Grazing

Most of the cattle fattened in New Zealand are left as entire bulls and are grazed all year round. Bulls are used as opposed to bullocks because they are more efficient converters of grass and can be finished at an earlier age. The recently weaned bull calves are turned out to grass but are also fed 1 kilo of pellet per day for a few weeks. This is then withdrawn slowly and the calves are left to graze until fattened. The whole fattening process is based around a low input system. Bulls are bunched up and put in smaller paddocks, enclosed by electric fencing. They are then moved on every day, or every two days, so that they always have fresh high quality grazing. Set stocking is becoming a system of the past and the system described resembles paddock grazing.

The psychology of this approach is that their movement mimics mob grazing, similar to that of the Great Plains, whereby a herd will graze intensively over a small patch. After resting, they will then move on to another patch and graze that entirely down, thus allowing new high quality shoots to emerge. Nutrients are returned to the sward through intensive defecation. Cattle are not housed in the winter but left in slightly larger paddocks which provide enough grazing for bare maintenance. In the spring, when grass starts growing, the speed at which they move around the paddocks is adjusted, or conversely, the size of the paddock is altered. Bulls are kept within their respective herds and I was surprised to learn how they bonded to each other; again highlighting animal psychology. At about two years old, they were sent to slaughter *en masse* because any remaining bulls would be difficult to introduce to other bunches as fighting would ensue. The aim was to achieve a dead weight of about 275kg.

I questioned whether the bulls would be putting on any weight during the colder winter weather when grazing is in shorter supply. I was informed that this is never a concern as compensatory growth occurred in the spring when grass grows. Bulls are expected to gain about 0.8 kg live weight gain per day in the winter and up to 2.0 kg LWG per day in the spring.

The biggest problem with this system is pugging, or “poaching” as we would call it. This is where in wet conditions the cattle would make a mess of the soil. This was not as big a problem as we may have in this country as the bulls train themselves to eat rapidly for the first hour or so and are then content to lie down for the rest of the day. Little supplementary feeding is offered because this would arouse them and then more poaching would occur.

We must remember that New Zealand is sparsely populated and this system, with the British network of public footpaths, would never operate as well in the UK. Seldom do we see a field of bulls running free in this country. Also, under cross compliance in the UK, farmers are discouraged from poaching the land.

As an additional observation, I was quite surprised at how few suckler cows there are. I discovered that this is because the dairy industry is booming and many beef farmers had switched into dairying to maximise profits. Even more surprising to me, was how few sheep there were, especially on the Canterbury Plains on South Island where dairying is also taking precedence

8.2.1 Case study - Alec Jack & family, Northland, NZ

Alec and his wife Kelly farm 1,400 acres in the Northland area of North Island, New Zealand. Much of the farm has been subdivided into 5-8 acre paddocks which are further subdivided into two or three lots with poly wires. Alec cites that this is done to gain more control over pastures and regrowth. Several hundred finishing bulls are fattened, mostly Friesian type bought from the sale yards.

Alec was selected to be one of the pioneers for the Kiwi Techno System, whereby the farm is carefully monitored on a computer and results are fed back to grass root farmers.

Photo : Fattening bulls grazing

Photo : Weanlings grazing on Techno System

8.3 Feedlots in New Zealand

I was fortunate to be able to visit the biggest feedlot in New Zealand: Five Star Feedlot, near Ashburton, Wakanui , (http://www.teara.govt.nz/en/beef-farming/7/2). This feedlot takes in beef bred cattle (often Angus or Hereford) at about 18 months old from selected farms. The cattle are fed a computer designed diet so that they nearly double their weight in around 250 days. They use no growth promoters. All cattle are electronically identified and therefore fully traceable to their place of birth. They produce a marbled beef much valued by Japanese markets.

9 Observations and Recommendations

9.1 GMs and Hormones

A lot of beef farmers in this country can fatten cattle very efficiently without the tools that I have seen used abroad. Whilst growth promoters and hormones do definitely play a part in fattening cattle, their use should still be banned. The evidence to say that they are safe is inconclusive and, whilst this is the case, we should not be using them and restrictions on imported meat should be maintained. If these rules were to be slackened, we would have no excuse to prohibit imported meat and as a result our markets would be flooded. I started my travels thinking that we were at an unfair disadvantage but my views have totally changed.

This is also the case with GMs, which are certainly a tool of efficiency. However, their usage should be restricted to the countries which have already adopted them. I believe that genes from Roundup resistant crops might, sooner or later, cross boundaries into other crops, making them difficult to kill with spray. We are tinkering with the food chain and each small element of it, such as an aphid which is considered by a farmer to be a pest, plays a pivotal part in being the food element for something further up the chain. That said, there is an application for countries that cannot feed themselves and it may be that mass starvation necessitates the use of GMs to feed the people. This applies particularly in the case of crops that are bred to be drought resistant.

Again, I draw attention to the work of Professor D Huber of Purdue University, which is very interesting. http://farmandranchfreedom.org/gmo-miscarriages

Recommendations – maintain the status quo in this country but champion the foresight of the GM industry and keep abreast with developments.

9.2 Bio-ethanol and Bio-digesters

These are obviously a favoured way of producing energy. However, if as the experts predict, there is going to be an acute shortage of grain, I think that bio-ethanol plants and bio-digesters will only exacerbate the problems of feeding a growing population. The spikes in grain prices will in turn make these energy systems unviable and uneconomic.

Recommendations – Anyone thinking of building one of these plants should budget for inflated grain prices and see how this affects the financial viability of the operation.

9.3 Wastage of Food

Often two thirds of some crops, such as vegetables, are never actually eaten by humans, I cannot see the sense in using natural resources such as fertilisers and fuels to produce them. I visited cattle fatteners in the UK who are using waste products such as bread, vegetables and fruit bought in by the lorry load to fatten cattle. Whilst this looked efficient, the waste product should never have been available in the first place.

Vegetable waste mountain on UK beef farm

Recommendations – Promote the smaller high street fruit and vegetable stalls. I admit there has been a resurgence of farmers markets etc. which offer a window to sell what the supermarkets class as inferior vegetables, ie bent or marked specimens. Promotion is not the entire answer though and I believe that financial concessions could be made to High Street shops in the form of reduced Rates. Conversely, supermarkets could be subject to a waste tax on everything they do not sell.

9.4 Animal Psychology and Fattening Cattle

Animal psychology is playing a greater role in fattening cattle. Docile cattle are more efficient at converting feed to meat as shown by trials in the USA. In this country, I believe we will see a greater resurgence of native breeds. Right the way across America, breeds native to the UK could be seen; it became obvious that these UK breeds were selected for their temperament and good mothering abilities. In the UK, therefore, I think Continental breeds such as the Blonde Aquitaine or Limousin, will lose popularity.

Recommendations - Beef farmers could do well to consider our native breeds such as the South Devon as a terminal sire.

9.5 Belly Clipping

Cattle in abattoirs in both USA and New Zealand are not belly-clipped before slaughter. In the USA the cattle are slaughtered and then jet-sprayed with warm water before evisceration. In New Zealand, they are overhead sprayed in lairage pens and within the slaughter chute. In the UK, we have to belly clip cattle before they go to the abattoir which is not only a dangerous practice but also places an unnecessary stress on the beast.

Recommendation – The practice of belly clipping is not necessary pre-slaughter and could easily be outlawed, making it safer for operator and kinder to the animal.

See photos on next page.

Photo: Nozzles in the roof spray the beasts to cleanse them. They also act to calm them, highlighting how docility is important to the beef industry.
Location: AFFCO Abattoir, Fielding, New Zealand

Photo: Cattle at US feedlot without ear tags. See 9.7 below.

9.6 Contribution to Research and Development

There is some interesting work being done, particularly in the United States, regarding recognition of genetic traits such as the isolation and recognition of docility genes. The results of these studies can be used universally.

Recommendation - In the absence of Research and Development in this country we should contribute financially to their Research programme and reap the benefits of the results.

9.7 Traceability

The UK has a most advanced system for tracing individual animals. Many cattle in the USA feedlots had become so bored that they had chewed each other's ear tags out and, whilst records could highlight which lorry a particular beast had arrived on, it may not be possible to pinpoint the specific ranch at which it had been born and certainly not its lineage. See photo above.

9.8 Controlling the End Price

There were some very big beef farmers in the USA who were being forced into becoming price takers simply because they could not find enough buyers to take their commodity.

Recommendations – Do not fall into the trap of believing that if you are a large scale beef producer or indeed a big producer of anything, that you have clout to set your price. Quite often as you become bigger you become more obliged to sell to a big buyer on contract, who then sets your price.

(continued on next page)

9.9 Soil and the environment

We should never forget that our biggest tool of efficiency is the soil in which we grow our crop, whether that crop be corn or grass. Soil should therefore be our primary focus. Farmers should be keen to work with nature.

Recommendations - Environmental Schemes should be embraced by all farmers. Get your soil analysed: You cannot farm efficiently if you have no idea of where you are starting from. Seed merchants are keen to get your business and will often give you a free soil analysis if you ask for it.

9.10 Water

I was expecting to see mass irrigation in America but what absolutely astounded me was how prevalent it was in New Zealand. In the South Island, crops were growing out of stony alluvial river beds which, to me, is almost hydroponic farming. The potential to produce grass from this system was remarkable and driving through Twizel, Central South Island, it was almost like witnessing a miracle. Cattle were being fattened beneath these gigantic central pivot irrigators, grazing grass at knee height against a backdrop of absolute desert. Seeing was believing.

I accept that water shortages are becoming more prevalent and this type of mass irrigation should not be allowed in the UK. The photos below do, however, show the effect that water has on increasing food production: a far greater effect than ever either GMs or fertilisers have or could have.

Recommendations – Farmers should make better use of natural water to feed their beef cattle. Grants could be provided to farmers within environment schemes, to construct bore holes or water pumps from natural water supplies to feed cattle-yards.

Photo: central pivot irrigator in Twizel, NZ

Photo:The 'miracle'

10 Conclusions

- When I started my Scholarship, I thought that UK farmers were disadvantaged by not being able to use GMs and hormones as a tool that would help them become more efficient in fattening beef.

- I have completely surprised myself by agreeing with the EU policy, whereby we protect our industry. Should we be allowed to use growth promoters and hormones we would be put on the same footing as the rest of the big global beef producers and we would have no excuse to stop a flood of imported meat saturating our market.

- All the systems I witnessed are very efficient ways of producing meat but we have to remember we can only work within the given parameters. And these parameters can change at any moment, so we must adapt accordingly.

- The Pastoral System of New Zealand works very well because of the docility of the cattle. Over here in the UK, with the Continental breeds that are very flighty, it would have limited use. Cattle would not respect the electric fencing. I do however recognise that, under this system, cattle would always be eating the highest quality grass and stocking rates would be greater.

- To graze beef cattle in the UK, set stocking seems to work better purely on a management front and, to a degree, we can achieve the same result - high quality grazing - with the use of perpetual topping. This acts on the same principle as tight grazing because it removes the old poor quality grass. This is a practice that I have implemented widely since my travels.

- The feedlot system of America is obviously very intensive and cattle can be fattened very efficiently with this system which includes growth promoters. UK beef farmers should continue to mix and match our feeding systems, as we already do. This works very well because it is flexible and at times, when grain is expensive, cattle can be grazed. Conversely, when grain is cheap, they can be fattened economically indoors. The name of the game is to adapt to any changes. Look beyond the box: what you are doing today may not be right tomorrow.

- One thing for certain, though, is that UK farmers are champions within our industry. We sell a good product reared to a very high welfare standard, in an extremely environmentally friendly manner.

- Don’t ever be led to believe that we are not the best.

11 Where do I go from here?

Having started my initial Nuffield studies from a relatively low base, my Scholarship opportunities have certainly made me question how I shall farm in the future. Gone are the days when I will simply go through the motions of beef farming on a grassland farm. At the start of my investigations I would have classed myself as a very ordinary farmer, producing some nice crops and always looking over the fence at my neighbours to see what they were up to.

My studies have made me question my actions more as opposed to simply going through them. The Nuffield experience has been truly enlightening and I can recommend it to anyone within our industry. As I have proved, I have gained a comprehensive and useful insight into my way of farming. Similarly, someone coming in at a higher academic level would also benefit; scientists were keen to discuss their findings at a more intense level.

I met up with an array of very interesting people who have kindly spared me a lot of their time. I have discussed everything beef related and my horizons have been broadened. In the future, I look forward to hosting the friends and Scholars I have met on my travels.

The Scholarship has challenged me and turned me into more of a thinker. I have been fortunate enough to have rubbed shoulders with some very ambitious, forward thinking people who have inspired me to look beyond the box and realise that you can never catch up with the horizon. "*Follow the man who has a dream*" is a quote which comes to mind. At the same time, I have come to the realisation that success does not have to be monetary and many workers on a slaughter line show tremendous pride in achieving what is expected of them.

In New Zealand, I landed on the day of the earthquake in Christchurch. I witnessed the devastation it caused. Everyone was rallying around, offering assistance to those most in need. This sowed the seeds for an idea regarding recycling that I am now pursuing.

I'm not the same person that I was before my Nuffield experience took hold of me. I feel very humbled against some of the very successful people that I have met. Nuffield has opened doors that I would never have even knocked on and I feel very honoured to have been given this opportunity.

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12. Acknowledgements and Thanks

I would like to thank my sponsor The John Oldacre Foundation, The Nuffield Farming Scholarships Trust, and my family and friends for holding the fort. I would also like to thank the following for giving me their time, knowledge and hospitality:

Aeneas Ball, Oldbury, UK; **Mark & Michelle Bocock**, Chamberlain, NZ;

Dr Cole, Texas ARS Investigation Center;

Steve Cortinas, Dakota Premium Foods, Minneapolis;

Mhong Abattoir, Minneapolis; **Gwyn Davies**, mentor, UK ;

Mark Deesing, Grandin Livestock, Fort Collins , Colorado;

Dr Galen Erickson, University of Nebraska, Lincoln; **Keith Faulkner** U.K;

Five Star Feedlot, N.Z .**Dr Harvey Freetly**, Clay Center, Nebraska;

Phil Haywood, ABP, U.K ; **David Gore**, UK; **Gordon Hamilton**, Taupo;

Ulrich Herstall, Fairlie, NZ; **Paul Hinwood** NSch, mentor ,UK;

Alec Jack NSch, Pakaraka, Kaikohe; **Steven Jones**, University of Nebraska, Lincoln; **Delia and John Kibble**, Hamilton, NZ;

Dr King, Clay Center, Nebraska; **Alan NSch** & **Anne Beckett (Hon NSch)**

Harry and Scott Knobbe, Harry Knobbe Feedyards, West Point, Nebraska;

Pete McClymont, Nebraska Cattlemen; **Dr Ted McCullock**, Texas AG Life;

Paul McGill, NSch, NZ; **Mountain River Processors Ltd.**

John Maddux, Waunita, Imperial, Nebraska;

James Marsh, UK; **Warren Munby** AFFCO Abattoir, Fielding, NZ;

James Parsons NSch, Lamb & Beef NZ, Kaitaia;

Robert & Alex Peacock, Geraldine, NZ;

Christian Perversi, Cargill Meat Solutions, Schuyler, Nebraska;

Philip & Sheila Powell (Dad & Mum), Bridgnorth, UK; **Adam Quinney,** UK;

Desiree Reid NSch, Temuka, NZ; **Nick and Jessie Reis**, Minneapolis;

Bart Ruth, Nebraska; **John and Margaret Shearer**, Ashburton, NZ;

Bill Sotherland, Benmoor Station, NZ ;

Dr Sprous, Veterinary Diagnostic Center, Texas;

Kimberly Magin Sutter, Soybean Product Manager, Monsanto, St Louis, Missouri; **Dell Volmer,** Friona Industries, Texas;

William 'Buck' Wehrbein, Manager, Mead Cattle Company, Nebraska;

Dave & Flo Whiteman, Huntley, NZ; **Mark Youngs**, Hamilton, NZ.

13. Overseas itineraries

13.1 USA Itinerary

Mark Deesing Colorado State University, Denver, Colorado	Animal Psychologist and Behaviourist and Designer of cattle handling systems	Meeting
John Maddux Waunita, Imperial, Nebraska	Cattle rancher	Hosting a farm visit
Bart Ruth Rising City, East Nebraska	Farmer	Host and farm visit and tour of neighbouring 4,500 dairy cow unit
Christian Perversi Nebraksa	Cargill Meat Solutions Abbatoir	Meeting and tour
Harry & Scott Knobbe	Knobbe Feedlot	Tour
Local machinery dealer		Visit
William 'Buck' Wehrbein Mead Cattle Company	E3 BioFuels Bio-ethanol plant and feedlot	Tour
Dr Galen Erikson and Dr Steve Jones University of Nebraska	Meat Science Research and Teaching	Meeting
Peter McClymont	Nebraska Cattlemen	Meeting
Dr Harvey Freetly USDA, Clay Center, Nebraska	US Meat Animal Research Center (USMARC)	Visit and tour
Dr Cole Amarillo, Texas,	ARS Investigation Center	Meeting
Dr Sprous	Veterinary Diagnostic Center	Meeting
Dr Ted McCullock	Texas Ag Life	Meeting
Del Volmer Amarillo, Texas	Friona Industries Feedlot	Feedlot tour
Kimberley Magin Sutter St Louis, Missouri	Soybean Project Manager, Monsanto	Laboratory tour and meeting
Nick and Jessie Reis & family Minneapolis	Farmer	Host and tour of farm. Also have quarries, composting and waste disposal and metal recycling enterprises.
Steve Cortinas Minneapolias, Minnesota	VP Dakota Premium Foods	Abattoir visit and meeting
Mhong Abattoir Minneapolis, Minnesota	Abattoir	Tour

13.2 NEW ZEALAND itinerary

Meetings during the trip:

Alec Jack, NSch Pakaraka, Kaikohe	Beef Farmer	Host and farm visit
James Parsons NSch Kaitaia	Farmer & Director of Beef and Lamb New Zealand	Farm Visit
John & Delia Kibble Hamilton	Dairy farmers	Host and Farm Visit
Mark Youngs Hamilton	Farmer	Farm visit
Dave & Flo Whiteman Huntley	Farmers	Host and farm visit. Distinct environmental investment.
Mark & Michelle Bocock Chamberlain	Farmers & Calf rearing specialists	Calf Rearing Unit
Gordon Hamilton Taupo	Retired Farmer	Host and visit to TAUPO weaner calf sale
Gordon Hamilton's Son	Farmer	Farm visit
AFFCO Abattoir Fielding	Cattle Abattoir and processing plant	Visit abattoir
Paul McGill NSch Masterton	Scholar and Farm Manager	Host and farm visit
Desiree Reid NSch Temuka	Scholar and farmer	Host and farm Visit
John Shearer Hinds	Farmer	Host and farm visit
Robert & Alex Peacock Geraldine	Farmers	Host and farm visit
Bill Sotherland Twizel	Rancher	Farm visit
Five Star Feedlot Wakanui, Canterbury		Visit and tour
Ulrich Herstall Fairlie	Farmer Silver Ferns Meat Company	Farm Visit