Nuffield Farming Scholarships Trust

A Thomas Henry Foundation Award

Selection techniques and performance improvement in the suckler herd

William Haire

December 2010

Contents

"It is often believed today that successful breeders have some sort of mysterious methods, of which all others are ignorant. Instead the principles of the successful breeder are exceedingly simple………the difficulty lies not so much in knowing the principles as applying them."

Sewall Wright, 1920 (principal founder of theoretical population genetics)

Abbreviations

AAA	American Angus Association
AI	Artificial Insemination
APHIS	Animal and Public Health Information System
BCMS	British Cattle Movement System
BLUP	Best Linear Un-biased Prediction
BVD	Bovine Viral Diarrhoea
BW	Birth Weight
CAFRE	College of Agriculture Food and Rural Enterprise
CHeCS	Cattle Health Certification Standards
DLWG	Daily Live Weight Gain
DSE	Dry Stock Equivalents
EBLEX	English Beef and Lamb Executive
EGENES	Edinburgh Genetic Evaluation Services
EUROP	European carcass grading system
EID	Electronic Identification
ET	Embryo Transfer
EBV	Estimated Breeding Value
EPD	Estimated Pedigree Difference
ERT	Economically Relevant Trait
FCE	Feed Conversion Efficiency
FS	Frame Score
Ha	Hectare
HCC	Hybu Cig Cymru /Meat Promotion Wales
IBR	Infectious Bovine Rhinotracheitis
ICBF	Irish Cattle Breeders Federation
KPI	Key Performance Indicator
KTT	Knowledge and Technology Transfer
LMC	Livestock Marketing Commission
Lwt	Live Weight
M&WNZ	Meat & Wool New Zealand
MAM	Marker Assisted Management
MAS	Marker Assisted Selection
NBA	National Beef Association
NCBA	National Cattleman's Beef Association
NIRMTF	Northern Ireland Red Meat Task Force
QMS	Quality Meat Scotland
SNP	Single Nucleotide Polymorphism ("snip")
SRI	Self Replacing Index
USDA	United States Department of Agriculture
VIA	Video Image Analysis

1. INTRODUCTION

Whether or not farmers like it every aspect of agricultural production throughout the world is benefiting from the use of technological innovations; from sensors measuring the conductivity of milk, or tractors with automated transmissions, to sexed semen, we are all exposed to the benefits of technical innovations during the course of a working day around the farm. Modern technology is playing a major role in increasing productivity, improving profitability, reducing inputs and, most importantly, eliminating or minimising the risks of many of the day to day management practices on UK farms today.

Any discussion of "technology" referenced to animal breeding could produce a number of responses : artificial insemination (AI) embryo Transfer (ET) cloning or genetic modification (GM).

These may be the popular responses but they are, in fact, only methods of accelerating the rate of genetic improvement or incorporating traits that are more difficult to breed for naturally. These are part of an overall plan of genetic improvement within the herd that can be used after simple practices that are more affordable, applicable and accessible to beef producers - not to mention ethically acceptable to the public, our customers.

Deciding on which animals one wants to use these advanced breeding techniques is the key to making positive contributions to the herd and the point at which selection techniques need to be adopted. Traditionally that would have been a visual appraisal, but the advent of Best Linear Unbiased Prediction (BLUP) and the production of Estimated Breeding Values (EBVs) have given us additional information sources. These have now been supplemented by gene marker technologies to collect more information on traits that are difficult to measure or slow to quantify.

Unfortunately the uptake and perception of EBVs has met with quite a degree of resistance throughout the UK. Despite the length of time these have been available to cattle producers their uptake and acceptance is still relatively low. There are many reasons for this, possibly including the dislike of computers, supposed inaccuracy, relevance to the breeder, or a misunderstanding of the entire principle, to name but a few.

Other livestock sectors, such as pigs and poultry, have embraced and significantly benefited from the collection of data to produce breeding values for fertility, production or carcass traits to the point that breeding decisions will not be made without them.

The Northern Ireland Red Meat Task Force (NIRMTF) report published in 2007 highlighted the disparity between the costs of production and returns from the production of beef and lamb. Whilst the report insisted an increase in the finished animal price was essential to continued supply it also highlighted the need for greatly improved efficiency and cost control at farm level. Measuring and improving the performance of beef cattle on farm is an obvious contributing factor to this and to my mind the most economic solution available.

The purpose of my study is to establish not only the practical benefits and application of EBVs and Gene Marker technology, but also ways to pass on the knowledge and skill to others helping them put the information to good use in a planned breeding programme.

The study is not confined to these areas and I hope to consider other practices and theories which will play a role in making more informed breeding decision.

The most important feature must of course be the return on the investment made in the adoption of these systems and in the additional cost of superior breeding stock.

The human eye has been the selection tool of choice for cattle breeders for decades but now it is time for breeders to use their eyes to see how viable the complementary technologies are!

2. PERSONAL

I farm in partnership with my parents and uncle on the hills to the west of Belfast City. The farm rises from around 750 to almost 1200 feet on both northerly and southerly aspects, with the soils ranging from heavy loams to deep peats. We farm 220 acres, 180 of our own, with the balance taken on annual lets. Loughanhill Farm is home to our Dorepoll Hereford and Maverick Aberdeen Angus herds numbering about 60 head. We have been breeding Hereford cattle for 36 years but are still relative new-comers with the Angus herd established in 2008. Loughview Farm carries our commercial suckler herd based on Ayrshire/Friesian X Hereford cows mated to native breed sires. We have recently moved on from Beef Shorthorn to Aberdeen Angus sires, alternating each for two breeding seasons.

The whole farm is in grass with approximately 60 acres improved and the remainder of moorland and high organic matter land, all designated "Severely Disadvantaged".

After agricultural college I spent 5 years working for a national feed company, before returning to work on the family farm. At the same time I have had the chance to work in Canada and the USA with some of the leading Poll Hereford and Angus herds learning about their production and marketing policies. During this period we have made massive improvements within our own herds having adopted many North American management principles. We have been using ET successfully to introduce new families to our herd and improve traits where we felt weaknesses existed.

3. WHY I WANTED A NUFFIELD SCHOLARSHIP

Whilst I have been involved in showing cattle for most of my life and been lucky enough to have a great deal of success along the way, both with our own and on behalf of other breeders, I have become increasingly concerned that pedigree cattle breeders are becoming more and more detached from the "real world" of cattle production and the requirements of the modern processing and retailing sectors.

Producing cattle which look good is simply not enough given the pressures being exerted on suckler beef profitability. We must consider the implications of environmental protection, water shortages, spiralling energy costs and a plethora of regulations and red tape, current or expected.

The purpose of my study is to investigate modern selection techniques used to make better breeding decisions that can lead to improvements in efficiency, performance, profitability and the lifestyle of beef producers in the UK. In addition to meeting many breeders throughout the UK, I visited three countries I considered to be progressive and which are actively developing techniques to drive genetic improvement in their national herds in order to secure the long term future of their beef industries. I should add they are also spending considerable amounts of levy, private and public funds on research into all aspects of the beef supply chain.

Primarily I set out to learn more about Estimated Breeding Values (EBVs) and the factors that contribute to their production and use at farm level, and to learn more about the new science of Genomics and its use for selection and management.

I looked at other aspects of breeding stock selection including performance measures, recording systems, information use and knowledge transfer.

I found it invaluable to meet the scientists carrying out research and developing new ideas, but even more so to meet the cattle producers using the techniques within their herds to ensure they have a long profitable future producing beef.

4. MAIN REPORT

Background

During the last 250 years the UK has been the genetics capital of the world, exporting breeding stock around the globe. The names of Robert Bakewell and Benjamin Tompkins are synonymous with British farming, laying the principles of artificial selection used in the development of many breeds of livestock farmed today. In many instances not much has changed from those days with a "good eye for a beast" and some knowledge of its pedigree being all that is required to make an informed breeding decision.

Having spent my whole life around pedigree cattle, it is fair to say that I have had a very "specialised" up-bringing in the cattle industry. Until the point of embarking on my Nuffield Scholarship I had concentrated on achieving physical perfection within our herd. The thrill of producing the next 'great one' has been and will continue to be my motivation, but the definition of what constitutes a 'great one' to me has changed a lot.

Traditional breeding systems, following in the footsteps of Tompkins have served us well, making many of the successes we have achieved to date possible and elevated us to the level within our breed where we stand today. It was therefore quite a revelation when our Dorepoll Herd joined the UK Hereford Group Breedplan performance recording scheme. This was a cautious move, made because we felt we had to, if we were to avail of new opportunities and markets.

The usual conversation around the sale or show ringside follows a regular pattern:

> *"That's a powerful animal, but those EBVs don't rate him at all, but what would they know anyway?"*

Everyone concerned will generally dismiss the theory that there is anything to be learnt about an animal beyond what the eye can see. Through my study I have learnt why many visually outstanding looking cattle have poor EBVs and many ordinary cattle have extra-ordinary EBVs.

Being a confirmed technology addict, I have had to come to terms with what seems like a religious dilemma. I want to believe, but haven't yet found the evidence to convince me.

Using my Nuffield Farming Trust Scholarship I set out to learn about :

- **modern cattle breeding**

- **the selection techniques used by other nations**

- **the performance recording systems in use.**

Very early in my study it became apparent that selection tools were only one part of genetic improvement and without a breeding plan changes could not be made.

Method

This study focuses on the practical application of techniques that can be used to make better informed breeding decisions that are more accurate and profitable. Many of the opinions available are based on academic knowledge as, unfortunately, it is much more difficult to find those with the practical on-farm experience.

I visited a variety of organisations and operations: cattle breeders (pedigree and commercial herds), cattle feeders, research organisations, breed societies, universities, industry bodies, commercial companies, trainers, advisory organisations and consultants.

I looked for contrasting opinions and theories from these sources to help me form opinions based on the circumstances they are working within, to help develop recommendations relevant to the UK.

I have included best practice reports, detailing outstanding cattle businesses visited during the course of this study, which gives a more in-depth description of their practices and what made them outstanding in my opinion.

It is important not to get "bogged down" in the technical jargon and background science any more than necessary for the purpose of gaining a working understanding. Whilst I have been exposed to this, I have tried to avoid its use in this report, saving the reader from unnecessary complexity whilst still highlighting some of the mechanisms involved.

My goal throughout this study has been to witness how beef producers globally used the information available to them and see how the UK beef industry could adopt practices to make British beef farming more efficient, profitable and sustainable.

5. COUNTRIES VISITED

After spending time in the UK visiting various organisations, my study tour took me to:

- **the Great Plains of the USA**

- **the North Island of New Zealand**

- **and Eastern Australia.**

For the purpose of this report I have dealt with each of the overseas countries individually, highlighting some of the factors influencing their beef sector, the status of their genetic improvement and the adoption of modern breeding principles.

I visited many outstanding businesses, a few of which I have detailed individually, and all are listed in the "thanks section" at the end of this report.

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

6. USA

During the time I spent in the USA I visited the States of Georgia, Colorado, Kansas, Nebraska, Iowa, Missouri and Oklahoma.

Beef production in the USA is steeped in history and romance, with references to the Old West extending throughout the Great Plains. The movie images of Cowboys riding into the sunset on a long cattle drive may seem dated in the age of wireless internet but hard work, determination and passion still drive the US beef industry. Western values are as relevant today as in the days of the great cattle drives to "Cow-town", Dodge City, with cattle converging from hundreds of miles away to the rail heads taking them across the nation to feed a hungry population.

Beef production here comes predominately from cow-calf systems or suckler cows as we refer to them. The cow-calf producer is generally operating an extensive pasture based system with minimal human intervention. In the regions I visited there are distinct specialised farming systems, with the quality soils being used for the production of corn, wheat, soya beans and other high value crops, whilst the more marginal and poor ground is the realm of the suckler cow. The US beef cow inventory stands 31,376,000 head, out of a total cattle population of 93,702,000 head at 1/1/2010 (*source: NCBA*)   In retail equivalent value the US beef industry is worth US $73 Billion in 2009 (*source: USDA*).

The selection principles operate on a "ground up" basis. Females must have :

- sound foot and leg structure to cover long distances searching for grazing and water

- a well attached udder with small teats so calves can suckle quickly and easily at birth

- a large pelvic area and optimal pin angle for ease of calving

- lots of body capacity to carry a calf and accommodate a large rumen to convert the low quality forage into energy and milk

Size is an important feature with ranchers commonly preferring moderately sized cows in the 525- 625kg range (they will use 600 day and mature cow weight EPDs when selecting sires to produce this). Although these cows may be small by UK standards, they are none the less hard working. The industry standard is for them to wean a calf of 40% of their own bodyweight to an adjusted weaning age of 200 days. Actual weaning age will depend on the season, cow condition and feed availability.

Below the skin, cows must have the ability to calve at 2 years old, be highly fertile, re-breed quickly, last a long time and do all this un-assisted on minimal resources.

In most instances it is a return to a near natural system where natural selection kicks in to eliminate the individuals that don't fit the environment and situation.

Bull selection works on a similar basis, given that he is providing half the genetic material of the resulting calf. Mobility is even more important as he will not only have to graze and seek water, but also mount at least 50 cows and in many instances

8

defend himself in situations where several bulls are turned out into large groups of cows. AI is practiced on ranches large and small, both pedigree and to a lesser extent commercial. With reference to historic values and modern techniques, it is not uncommon for cowboys to gather in season cows into corrals to AI them with sexed semen, recording the details on a pocket PC - a perfect example of old and new ideas working comfortably together.

As would be expected in such a large country there are many different production systems and as a result many different demands for certain traits. The use of EPDs is a second language in the pedigree sector with great emphasis placed upon their use. Many breeders have in fact moved to the point where they give priority for selection and mating to EPD values. Breeders with a solid understanding of EPDs can easily predict what an animal will look like from the numbers provided in the individuals EPD profile. This has been a long term development but those herds I visited using this practice were benefiting immensely.

Uptake of EPDs amongst commercial producers is generally not as strong, although does vary depending on the abilities of the producer and breed of bull the rancher may have identified as best suiting his system. This applies particularly to Angus cattle which are numerically the largest breed in the country at present. The American Angus Association has a membership of over 30,000 cattle businesses! The sheer number of animals involved has created a problem because there are so many cattle it is difficult for the unskilled to differentiate amongst the animals they are studying. To ease this situation Index values have been developed which can pin-point where the animal's strengths lie for various outlets and provide a financial estimate of their benefit.

Management seasons follow a fairly standard format, regulated by harsh winters and seasonal grass growth patterns. Ranchers will calve their cows in March and April as weather hopefully improves and grass growth starts, and wean in October and November.

The majority of commercial calves leave the farm, moving to either a backgrounder or feedlot. Back-grounding is taking the calves through the post weaning phase and preparing them for intensive feeding over a shorter period later in their lives.

Beef cattle finishing is mainly focused through the "grain belt", from Texas in the south, through the Great Plains as far north as Colorado. The majority of the smaller operations of up to 5000 head capacity are family-owned, although there are many of 100,000 head plus operations privately owned. It is relatively uncommon for ranchers to finish their own cattle. There are several large businesses feeding cattle on a large scale, notably the Brazilian owned JBS Five Rivers. Based in Colorado it feeds cattle across eight states, with capacity for over 800,000 as well as 8 processing sites under the JBS Swift name.

Best Practice example : Decatur County Feed Yard - Oberlin, Kansas

Decatur County Feed Yard (DCFY) is situated in the heart of cattle and grain country. The Yard has capacity for 38,000 head at any one time, coming from a customer base of 210 ranches in 42 different states including Hawaii (using Jumbo Jets to fly them in!). The majority of cattle are fed and marketed on contract for their breeders but DCFY also own a substantial number themselves and manage cattle on behalf of investors. Cattle are fed both on a hormone free management programme, making them eligible for European markets and traditional hormonal implant programmes for domestic markets. Separate feed equipment and areas of the yard are used to segregate the systems ensuring no contamination takes place.

Picture 1: Cattle on feed at Decatur County Feed Yard

All cattle entering the yard are hip height-measured for frame scoring (appendix 1), is weighed, vaccinated (depending on origin herd vaccination policy), treated for internal and external parasites and given an individual Electronic Identification (EID). The EID is central to the function of the feedlot, allowing individual measurements, treatments and costs to be allocated to every individual on the site as well as easing workload and improving traceability right through to slaughter.

DCFY uses an electronic cattle management system which is part of a system designed by a company called Micro Beef Technologies and works in conjunction with Micro Beef's Accu-Trac® software to sort cattle based on a wide range of physical and economic measures. This technology allows DCFY to exploit the performance potential of every animal as an individual instead of a group which is the common practice in US feedlots.

Cattle will spend between 180-220 days on site. During this time they will be sorted at least twice when they will again be measured for frame score calculation, weighed and ultrasound scanned, measuring the animal's back-fat, rib-eye area and intramuscular fat. Using this information the software can determine the finishing strategy for that individual, comparing the costs of gain for the current level of performance with current and future beef prices, determining the most cost effective point to slaughter. The aim is to maximise return on an individual animal basis by achieving high feed conversion efficiencies with maximum carcass weights, without incurring weight penalties.

The DCFY operation is a lesson for the whole industry. The DCFY beef alliance has replaced many of the traditional negative and confrontational relationships between ranchers, feeders and processors with a co-operative relationship which results in a more open flow of information and economic incentives for producing better beef.

All physical and financial information collected on the individual animals including all the slaughter data is reported to the owners after their consignment has been fully marketed.

This information can be used to make breeding selections by highlighting the profit makers and debt creators, showing where management can be improved and where breeding and culling strategies can be applied. Sire identification can be difficult to determine in multiple sire mating groups but with some planning and reference to records, potential sires can be identified. The advent of DNA parentage tests will be of great benefit if the cost is low enough!

7. **NEW ZEALAND**

During my visit to New Zealand I stayed on the North Island carrying out visits and meetings from the top of Northland and south through the Waikato Valley to Wellington and as far east as Napier.

Having left behind the vast expanses of the USA, NZ came as quite a contrast, with lush pastures and highly intensive grass-based farming systems, epitomised by the minimal number of farm buildings and extensive use of electric fencing and paddock grazing for all stock types. New Zealand is widely recognised as a low cost producer of meat and dairy products. In its post subsidy years, management systems have been adopted to capitalise on the greatest resources it has - grass and open minds! Although more widely recognised for its dairy and sheep industries, the country has a beef herd of over 4.3 million cattle, 1.3 million of which are beef cows.

In export value terms beef and veal production was worth over NZ$1,657million in 2008. To put this into perspective with the other main sectors: lamb was worth over NZ$2,171million dairying was worth NZ$9,639 million in the same year:

In 2008 the country produced 634,000 tonnes of beef and veal with over 351,000 tonnes exported (M&WNZ farm facts 2009).

Traditionally the NZ beef herd has been based on calves produced from beef cows, but an alternative system - based on rearing calves from the dairy herd as either bulls and steers for slaughter or heifers for replacements - has become popular. The dominant breed is Hereford followed by Angus as sires in both the beef and dairy herds. The main dairy breed is the NZ Friesian. The Friesian, when crossed with either of the beef breeds mentioned, provides a much more suitable beef cow than the Holstein commonly found in the UK.

Beef cattle and sheep are usually farmed together and are complementary to one another especially under hill conditions. As a result of better profitability in the dairying and sheep sectors, beef cattle production is becoming a "Cinderella" enterprise. Dairy herds are expanding into sheep country, sheep into beef country and beef into the hills. It is difficult to appreciate this from a Northern Irish view, where the role of sheep and beef cattle would be reversed, but given recent profitability improvements in the sheep sector, it is possible. This is perhaps a sign of what the future might hold for the UK when we eventually move from the traditional era into a business focused one.

The selection criteria for females are based on similar principles to the USA where sound functionality takes priority over all other traits. While the challenge may not be to cover vast areas searching for feed and water, mobility is of major significance in the tough hill country common throughout NZ. Low levels of human intervention are a fact of life. In an effort to maximise the number of cattle one person can look after, anything that disrupts the stockman's routine contradicts this policy. Cow size too is of major importance in the drive for greater efficiency, as it has been proven in commercial circumstances that large cows do not necessarily produce heavier calves at weaning. A large cow by NZ standards would be approximately 550kg Lwt, with a hill country cow coming in at 100kg less.

Once again the expectation is that heifers will produce their first calves at two years old and all cows targeted to wean a calf which is 50% of the dam's bodyweight at 6 months old. Cows are given a relatively small window of opportunity to get in calf, with bulls only turned out for 7-8 weeks. This keeps calf size consistent, easing management and marketing as well as focusing the workload in a narrow time frame. Any cows not in calf when pregnancy checked will go for beef after weaning. This has benefited the industry by removing cattle with poor fertility but has put pressure on management and genetics to ensure cows are in optimum condition at calving to rebreed and have the genetic ability to cope with the challenges faced .

Bull selection follows similar lines to cow selection. Bull buyers do not want animals that have been fed grain and are "soft". They are more likely to suffer poor fertility because they are unfit and lose condition during the early breeding season. Bull buyers look for breeders who produce bulls under similar conditions to their own, in terms of farm type, herd management practices, feeding regimes, disease status, etc. Breeding soundness checks are routinely carried out as are service capacity tests. Many of the large studs will have their own scoring system for traits that are not covered in any other standardised format, in order to assist their customers' decision making.

The use of EBVs is widespread amongst the leading and progressive herds, commercial and pedigree, although there is still a minority avoiding their use, but they tend to be the small hobby farmers whose focus is on showing and who are not commercially relevant. There is a very large gap between the 'show' people and the 'real' cattle breeders to the point where the good cattle breeders do not attend shows nor do they consider shows relevant to their business. They are not prepared to sacrifice their superior genetics for five minutes of fame.

I saw many examples of herds where the breeding decisions were made solely on the animals breeding values, with outstanding results. However it is more common to see a balanced approach to decision making. Professional breeders generally have a thorough understanding of what they are trying to achieve and will select bulls to bring certain traits that will strengthen weaknesses or further develop aspects they are trying to improve. Index values have been developed to cater for specific NZ requirements including a Dairy/Maternal index aimed directly at dairy farmers buying bulls to turn out with their heifers and cows with the focus on calving traits.

NZ farmers are very aware of the aspects of their business that make them money and those that cost them money. As a result they have a wide range of Key Performance Indicators (KPI's) which they use to measure their businesses and compare them with others. The levy organisations and advisory services have been involved with the development of these standards, which are a second language to producers across all stock types.

Finishing cattle is based on grass alone. I did not come across anyone feeding concentrate type rations to beef cattle at anytime. The standard of grassland management on all soil types is such that the growth rates they can achieve are for the most part higher than we can achieve using concentrates. One farm I visited was achieving a DLWG of 2Kg/head/day with Friesian bulls!

**Best Practice example - Ardo Hereford Stud,
Morrison Farming, Marton, NZ**

Morrison Farming is a family owned farm, with a breeding herd of over 600 Poll Hereford females and a Wiltshire poll based sheep flock with 5500 ewes producing 9000 lambs. This is where I saw a brand within a breed being used to develop and market selection traits.

The Ezicalve® brand was registered by the NZ Hereford Association in 2002 and subsequently sold in 2008 to the Morrison family and two other herd owners. The trademark is not for their exclusive use and can be used by any NZ Herefords breeder adopting the Ezicalve® principles.

The criteria for Ezicalve status falls into two distinct areas, the herd and the bulls.

Herd

- All yearling heifers are pregnancy tested in calf.

- All empty cows and calves are culled.

- All cattle are fully Breedplan performance recorded.

- Herd must be large in size and integrated with sheep or other enterprises.

- With herds a cooperative breeding approach is necessary sharing and cross-referencing sires.

- Must have a comprehensive herd health plan.

Bulls

- Must rank in top 5% for low BW from all NZ Breedplan recorded Herefords.

- Must rank in top 10% for dairy /maternal index.

- Both sire and dam are in top 10% for low BW and dairy/maternal index.

- Bulls must be born in Ezicalve herds.

- Bulls must be managed in large groups.

The Morrison family made a move to specialised bull production after carrying out extensive market research amongst their customers and more importantly non-customers, to define what they expect from the bulls they purchase carrying the Ardo prefix.

Each year the dairy industry requires over 20,000 new bulls to get the cows and heifers in calf, with a specific goal, a problem free calving. This was the determining factor for Morrison Farming in their business progression and marked a move to closer working relationships with their customers. Their largest customer groups are specialist dairy farmers (40%) but more importantly those with integrated beef finishing units (50%).

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

Only bulls that qualified for the Ezicalve status carry the mark on their sale catalogue entry. It is hoped that through time this will be all the bulls going through the sale. In 2008 Ezicalve sold 180 yearling bulls between the two members for an average sale price of $2137NZ, with those carrying Ezicalve status attracting a premium of $500NZ.

The success of the entire operation revolves around the integrity of the people and their farming operation. Applying high levels of selection pressure and managing the herd on a totally commercial basis means that customers know exactly what they are getting, which is shown by the fact that 60% of the bulls sold go to repeat buyers. I should add that their customers are not exclusively dairy farmers for a considerable number of the bulls go to commercial suckler herds.

Morrison Farming is a perfect example of how cattle businesses can work closely with their production chain partners to fulfil demand. The chain in this case seems quite short with the end customer being the dairy farmer, but delve a little deeper and it goes much further. They not only supply the bulls but have created a strong demand for the resulting calves where the supply cannot satisfy requirements.

Picture 2: Group of young bulls at Ardo Hereford stud

8. AUSTRALIA

The third and final stop on my trip took me from the cold wet spring in NZ to the heat of an Australian spring. The maps of Australia I used in planning my trip did not do the size of the country justice. Everything is truly bigger in Australia, including the isolation found once a town or village is passed by. The environment is harsh and brings a whole new set of demands for the cattle that utilise the feed that is available. Crops grown are no different to the other countries I visited but conservation of moisture and nutrients are a top priority for growers.

I spent a total of three weeks travelling throughout NSW and Victoria. I spent a full week at Armidale, the hub for beef production knowledge in Australia and the home of the Beef Co-operative Research Council (Beef CRC), Breedplan (the largest performance recording company globally) and many breed societies, researchers, extension groups and companies.

Australia covers an area of over 769 million ha of which over 409 million ha is classed as farmed land. Meat producing cattle totalled 25.3 million in 2008-09 and accounted for 90% of the total cattle herd.

Beef farming is responsible for 30% of all agricultural business (*Australian Bureau of Statistics*). There are 89,647 beef farms in Australia producing 2.2million tonnes of beef and veal annually. The beef industry is valued at $7.35 billion/year (*National Farmers Federation*).

Having come to terms with the vastness of the country, the next obvious contrast was the distinct lack of water. Once again the innovative grassland farmers here have adapted their systems and breeds to suit the resources available. Surprisingly I came across the same feelings amongst farmers about performance recording, with breeders either loving or loathing EBVs.

One of the really exciting observations which all UK beef Scholars return home with is the **MSA carcass grading system**. I, like my predecessors, came back to the UK wondering how producers can accept selling finished cattle on a system which does not value the product properly and, more importantly, disappoints our customers due to inconsistent eating quality, potentially driving them to other meats.

The beef herd is based on a suckler system as in the UK except that they have minimal dairy influence. The country is divided into two main climate types with cattle breeds that are adapted to the climates in the Northern and Southern regions.

Cattle in the Northern or tropical region are primarily of *Bos indicus* sub-species whose breeds include Brahman and Santa Gertrudis. These cattle cope not only with the extreme heat and humidity but also the fodder shortage and tick infestations with which *Bos Taurus* (European breeds such as the Hereford or Angus) sub-species would struggle. These cattle may be crossed with either *Bos indicus* or *Bos taurus* sires depending on the environment on the farm and the target markets. A large percentage of the cattle in the Tropical North are owned by farming corporations, extending into the millions of hectares, exporting the progeny of their breeding herds live to Asia from ports in the North of the country.

The cattle in the Southern region are predominately European or British breeds. Angus and Herefords make up the majority, with Charolais, Shorthorn and Limousin making up the rest.

No matter what the breed, minimal human intervention is at the centre of all breeding decisions. For the most part, breeding decisions are based on the fundamentals of the previous two countries, namely mobility, fertility and maternal traits. There are many similarities with the USA, in that cows may have to travel long distances in search of forage and water. The industry "standard" for labour efficiency is 10-12,000 Dry Stock Equivalents (DSE) per each labour unit. This equates to 800-1000 cows or 8000 ewes per stockman. One DSE = one 55kg dry ewe.

This high ratio of cattle to stockmen means that there is simply no one available to deal with calving difficulties, failure to suckle or other weaknesses which UK producers have grown to accept as "normal".

It is normal to calve heifers for the first time at two years old with a short breeding season being the standard to keep group sizes large and ease routine management, vaccination and medication as well as ensuring consistency amongst cattle groups.

The majority of cattle are finished through feedlots similar to the USA. There is, however, mounting pressure on grain based finishing due to the ongoing drought resulting in less grain for feeding as crops yield poorly and interest grows in bio-fuel production.

Breeding bulls are marketed through both National sales and at many on-farm events where potential customers visit the farm in conjunction with a field day. The leading bull breeders have an awareness of their customers' demands and can develop assessment criteria to help select bulls. These are supplemented by schemes that assist their management and cash flow. Bulls will be developed in groups to ensure they are compared effectively by their EBVs but also to ensure they are tough enough to withstand competition from other bulls in group mating scenarios and also from dominant cows in the herd.

Many of the management principles used in Australia are similar to those used in other countries I visited and have been discussed previously.

Best Practice example - Rennylea Angus, Holbrook, NSW

Rennylea is a family property owned and managed by Bryan and Lucinda Corrigan. The property extends to some 2000ha carrying the Rennylea Angus herd of 900 breeding cows with followers totalling 2500 head.

The motto of the business reads "creating your future in beef" and sums up the Corrigan's attitude to the way they run their business and how they encourage others to run theirs.

Rennylea Angus cattle are selected for net profit per hectare, rather than selecting for profit per head. This means that the young cattle are run at high stocking rates, and forced to perform and reproduce under limited feed availability during the year. This is particularly important for the selection of female replacements, and ensures that traits such as fertility are not allowed to slip, while selecting for growth and carcass traits.

For some years they have been measuring the efficiency of their production system through the use of benchmarking. Their confidence in the practice has reached a point where Rennylea actively encourage their customers to benchmark, paying half the first years benchmarking fee as a discount on the purchase of a bull from their sale.

Their success is in part due to the understanding of what drove profit. The goal within the herd is to develop traits that lower production costs, develop strong maternal characteristics centred on fertility and functionality, whilst making best use of the resources driving profitability.

Strict selection on the functionality affecting these traits across the entire breeding herd means that every cow has to earn her place in the herd, and ensures that the highest standards are attained. All females must calve for the first time at two years old (following a six week breeding period) and annually thereafter to an eight week breeding period. There are no second chances.

Unlike many breeders I have encountered, their aim is to *optimise* performance as opposed to *maximise* performance. The underlying target is to produce the most kg's of beef per ha as cheaply as possible, thus optimising the efficiency of the herd and land available.

It is, however, not enough to focus on efficiency alone as ultimately a carcass has to be produced. In addition to the traits I have mentioned, carcass characteristics are developed in parallel to ensure that the carcass produced realises as much value as possible from the processor, balancing inputs and outputs to reach the optimum level of return.

The Rennylea sale catalogue is packed with information about the cattle offered and the herd in general. A breakdown of their breeding objectives states the long term breeding goals and the herd's current position. Each bull in the sale has a comprehensive set of EBVs as well as his pedigree, birth date and identification recorded. In advance of the sale each bull is fertility tested and has a structural soundness assessment scoring their feet, hind legs, testicles, sheath attachment and temperament. Rennylea epitomises everything that a pedigree breeder ought to be.

They have strong ethics, are focused on running a profitable business and are motivated by the desire to do their job better.

Picture 3: Part of the Rennylea Angus breeding herd at grass.

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

9. SELECTION TECHNIQUES AND PERFORMANCE IMPROVEMENT IN THE SUCKLER HERD

As stated at the start of this report, I have felt for some time that there is more to breeding cattle than simply good looks. A more subjective approach has become necessary to sort through the growing numbers of cattle available to breed from, as a means of minimising the risk of making a mistake from which it could take decades to recover. In this section of the report I deal with some of the selection tools and decision support information sources currently available to us in the UK and introduce some new approaches and techniques which I feel will benefit our herds.

As the national beef breeding herd continues to shrink and the gap between cost of production and receipts widens, new practices and indeed existing ones need to be evaluated to consider their potential benefits in the future. The 21st century continues to throw 20th century problems at us as well as many new challenges, all of which require 21st century solutions!

Unfortunately many of the practices currently in use come from an era of grant aid and subsidies when it did not really matter if one got it wrong as a cheque would come along that would compensate for any shortcomings in the business. That era is drawing to a close so the opportunities for "getting it wrong" have to be identified and avoided, meaning some of the most widely practised systems will render themselves obsolete and become a part of our history.

The puzzle that lies before us is what to do about it. As there are many industry "experts", there are many solutions, mostly focusing on increases in scale, investments in equipment or resources and demands for a higher finished cattle price.

The aspect which I have chosen to discuss further is genetic improvement, where cattle are bred to work more effectively with the resources already available and within the constraints currently imposed.

Cattle breeding is a long term process. The results of breeding decisions put in place today will not be seen for 9 months, and will be at least a further 2 years in the case of females before we see how they perform and another 3 years after that before we see how their daughters develop. It is reasonable to assume that it may take 10 years to achieve a measurable response in some traits. All this is of course assuming that the correct decisions were made at the start and that the females and sires used, performed as predicted. This long generation interval is not only one of the drawbacks of trying to influence improvements in the beef production sector, but also a challenge to the professional cattle breeder. Anyone becoming involved in breeding cattle and expecting to see a rapid response is in for an uncomfortable journey and ultimately a short time in the cattle business!

Consumer trends and buying habits can change rapidly. These erratic buying habits unfortunately do not suit beef production systems given the extended time scales to which mother nature expects us to work.

The question therefore arises as to what we can do to reduce the risk of things going wrong, either within or outside our control. Unfortunately we have limited control of consumer demands (unless we are using direct marketing independent of the standard supply chain) so we have to work within the boundaries of our own control and knowledge. This gives us a great deal more flexibility than the majority of cattle farmers may believe as we are all still free to choose our markets and tailor the production systems to suit.

Breeders regularly blame the sire of the calves because the offspring are not what they expected. This point is discussed later in the report but it must be remembered that each parent provides half the genetic material making up the resulting calf and there are no guarantees which information they may transmit. They may share their worst characteristics just as easily as the best ones!

The risk is more pronounced with a bull as he spreads his influence across all the calves he sires in every herd every year, whereas a cow only produces one calf annually, so if it does all go wrong the implications for the cow are much less.

Although there are many instances on farm where individuals are selectively mated to correct or develop a particular trait, it must be stressed that we are dealing with population genetics where we as breeders should be trying to improve our herds or breeds as a whole by using the most suitable animals for breeding and culling those least desirable (see figure 1).
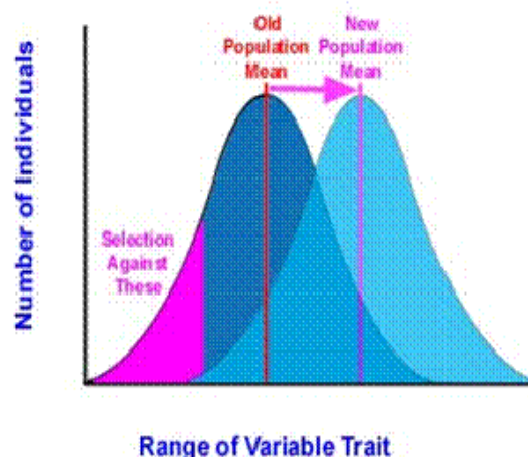
Figure 1: Standard deviation curve for any given trait

The point to remember here is that there is no question of performance improvement being the right or wrong answer; it is inevitable and has to happen. I have avoided setting targets other than to stress that a breeding programme is essential in every herd, because every herd is different and what works on one may not work on another. It is each farm's business to identify its strengths and weaknesses and make the necessary changes to what it does, to ensure the business will survive!

10. BREEDING PROGRAMME

What is a breeding programme and what does it do?

A breeding programme is a plan used to guide the herd owner towards the outcomes he has decided. It must be designed in a structured way, taking into consideration all aspects of his business and the customer whom he is planning to supply. The most important goal in the business is to make a profit so it is important to consider all contributing factors.

What contributes to a breeding programme?

The role of a breeding programme is to bring all the factors related to achieving the pre-determined goals together and map out the steps required to achieve them. It may be as simple or complex as the business determines necessary but will ultimately be decided on by the markets identified and the requirements needed to allow access to them.
The diagram below (figure 2) shows the elements that contribute to a breeding programme which will ultimately determine the success or failure of it and the business.
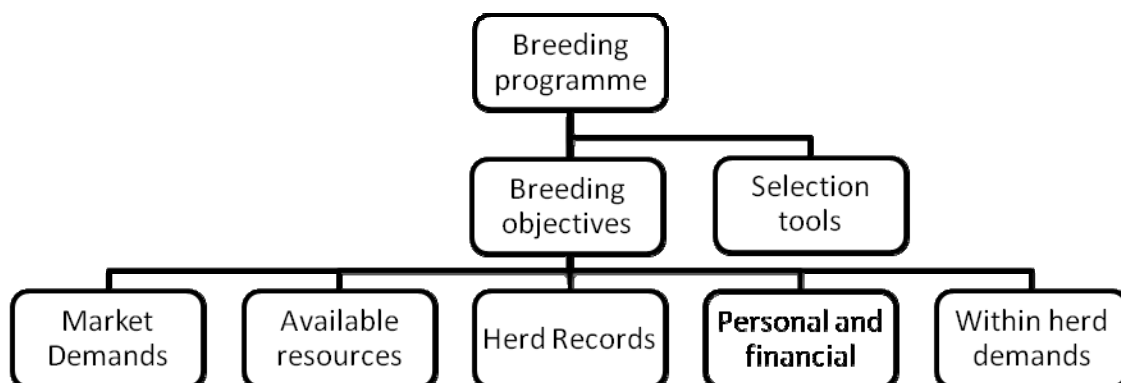

Figure 2 - Factors contributing to a successful breeding programme

Market demands: The chosen market should be the first area considered. It is important to note for whom one is producing and what it is they expect. It is easy to forget that one is producing food for a customer who has many options and if the product supplied does not come up to the standards expected they will look elsewhere. One may be producing cattle that go to another farm or to a processor but the ultimate customer is the consumer who eats beef.

The information required includes the existing market opportunities and what it takes to satisfy them. The main priority should be having some knowledge of processor requirements, added-value opportunities, bonus structures,

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

seasonality payments and special management practices on farm that will return a satisfactory profit margin should be the main priority. Opportunities exist to produce cattle for existing or new premium markets including those based on breed, provenance, eating quality or possibly the opportunity to breed commercial replacement females.

One of the factors restricting market focused production is the lack of information that passes along the production chain (figure 3). There is currently a good forward flow between immediate buyers in the form of product with limited interaction except between retailer and processor. It is vital that better relationships within the supply chain are developed to share requirements and knowledge which benefit everyone involved.

Figure 3 - The supply chain

Available resources: Everything on your farm that contributes to the success of one's business is a resource just as everything that detracts from that businesses is a liability. Available resources include the farm itself, its buildings, laneways, water systems, fencing, mechanisation, handling facilities and soil type. These are in addition to the composition and capabilities of the current herd of cattle, its calving season, quality of feed produced, available labour and one's own management ability.

This list is not definitive as each farm is different and every farmer needs to evaluate his own, but whatever they are, they will determine the types of stock that can be kept, the potential markets that can be reached and the extent to which improvements can be made.

Participation in environmental schemes may be included since pasture management, with certain prescribed breeds, can attract funding where grazing will benefit the flora and fauna.

Herd records: This aspect covers all the information collected both as legal requirements and voluntarily. How extensive the information collected is depends on the individual farm and the system operated but at the very minimum there is a substantial amount available through APHIS and BCMS.

The value of records cannot be stressed enough, no matter how insignificant they may seem. The key to remember is that they need not be complicated or require complicated recording systems. Notes in a pocket book or diary are sufficient to document any events or irregularities that occur on a daily basis that draw attention to a particular animal.

Where more radical changes are planned in-depth information will be required to pin-point current standards, setting a base line against which improvements can be measured.

Identification of cattle within the herd is of equal importance. As well as the legal requirement for individual tags these may be supplemented by

management tags, or freeze bands that can be easily read at a distance, ideal for recording breeding or health events. Electronic Identification (EID) tags can speed up data collection and prevent errors where the cattle are identified automatically and details recorded as they pass through a handling system. These are a very useful addition where the business has a desire for information or where labour is short.

Some of the many sources of information which cover various areas are detailed in the chart below (figure 4). The list is not exhaustive and will depend on the individual farms.

Legal/assurance records	Voluntary records	Physical measurement
Date of birth	Sire identification	Birth weight
Dam identification	EBVs	Calving scores
Breed	Sickness and health problems	Calf and cow weaning weights
Medical treatments	Breeding dates and records	Pre breeding weights
Feed purchases	Kill sheets	Regular monitoring weights
	Pasture utilisation- stocking rates	Frame scores
	Genomic predictions	Ultrasound scanning
	Benchmarking	Cow condition score
	Enterprise accounts	Grass growth
	Customer feedback	Feed levels and analysis

Figure 4 - Typical records that may be kept.

Personal and financial expectation: As every farm is different, so is every farmer. It is likely therefore that every farmer will have his own demands that will motivate him in different areas. The financial aspect could cover items such as fixed costs, funding sources, bank borrowings, future expansion, complementary farm enterprises and financial security. These will determine not only what can happen and how quickly, but also how big the risk associated with the developments may be.

Personal expectations could include quality of life, free time, spending time with family, personal satisfaction, participation in industry organisations or the freedom to follow other interests. All dictate the amount of time and risk that can comfortably be allocated to the business.

Within-herd demands: This section covers all the less obvious. But nevertheless necessary points for a herd to function. The risk of disease is an increasingly important concern with many cattle herds now vaccinating for a number of diseases as well as trying to run closed herds. Several schemes run throughout the UK.

Monitoring and advising on the control of four main diseases have become popular in recent years as the threat from Johnes, IBR, BVD and Leptospirosis has become more widely recognised. These schemes operate to the CHeCS standards.

Other factors to consider are replacement rates, structural soundness, maternal ability, replacement sources, level of human / cattle intervention, stocking rates and potential size of the herd.

Adaptability is a term I came across in the USA and is very straight forward. It is simply selecting and producing cattle that are adapted to the climate, environment and systems on any farm. Having a cow that can thrive on the farm instead of one which fails is a very obvious choice, but one which beef producers are not making. Many herd owners are forced to compensate (spend money without return) for their farms' inability to sustain a system just because the system does not suit their farms.

Breeding objectives: Having identified the key factors, the next step is to develop breeding objectives to fulfil identified market requirements. This ensures decisions are based on your particular circumstances. For example the objective may be to increase 200, 400 or 600 day weights depending on whether one sells weaned calves or takes them through to finish.

Selection tools: Selection or decision support tools are information sources used to help make better informed breeding decisions. They can come in any number of formats and may be generated on the farm or come from external sources, from data collected from the cattle on the farm.

I have already referred to the fact that what we see is not what we get if we depend on looks alone. It is vital therefore to have some additional backup information sources to help make decisions based on what goes on below the animal's hide.

11. ESTIMATED BREEDING VALUES

What is an EBV?

An EBV is a value which expresses the difference (+ or -) between an individual animal and the herd or breed benchmark to which the animal is being compared. EBVs are reported in terms of actual product e.g. days, kg of weight or mm of fat depth, etc. An example Breedplan EBV (appendix 2), breed ranking graph (appendix 2) and full description of traits (appendix 3) can be found at the end of this report.

There are two main performance recording services operating in the UK.

> The **Australian Breedplan programme** is used by many beef breeds in the UK and operates through Pedigree Cattle Services.

> **Signet/BASCO** is operated by Edinburgh Genetic Evaluation Services (EGENES).

Both systems produce EBVs for many of the same traits, with their databases being accessed via the respective breed societies. Sale catalogues that have EBVs included for each animal should also have an explanation of the traits and a chart showing percentile bands, depicting where the individual animal ranks within the breed depending on its performance for the traits in question.

Contrary to common belief EBVs are not a massive waste of time and money but an estimation of how the progeny of an individual should perform! The purpose of EBVs are to bring all the cattle within a herd or breed onto a common platform so that those making selection decisions can know they are comparing like with like regardless of the system or location they are produced in. It is important at this point to remember that each parent contributes half the resulting calf's genetic make-up.

This performance estimation measures the parts of the animal that the eye cannot see (figure 5). An animal's physical appearance (phenotype) is determined by two components, its genetics (genotype) and non genetic or "Environmental" influences. EBVs measure this genetic component and allow cattle within their respective breeds to be compared, excluding their management and Environment. The key point here is what you see is not necessarily what you get!

Genotype + Environment = Phenotype
Figure 5 - Factors that determine why cattle perform how they do

The environmental (non-genetic) influences include grass quality, disease burden, parasites, supplementary feeding, management ability etc. The environment component is a part that herd keepers have influence over and the ability to compensate for or enhance. Despite the environmental influences, the genotype remains the same and parents do not pass on to their progeny the environmental effects that have influenced them.

EBVs draw information from a number of sources in addition to the animal's own performance (figure 6). The basis is comparing individuals within a contemporary group, one to another, minimising non-genetic influences. The system also compares contemporaries in other herds where genetic linkages exist through siblings and

ancestors. This is a very simple description of what is involved to outline the principle. The actual calculations are much more complex and beyond anything that a farmer needs to know or understand.
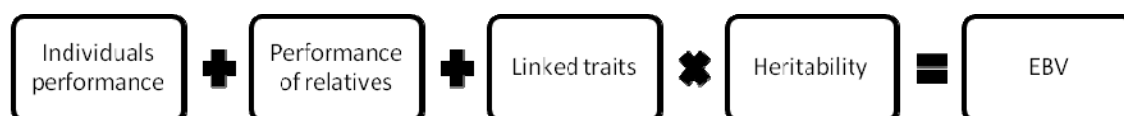

Figure 6 - Information sources used in producing EBVs

Linked traits are those which share common connections with each other. An example of this is that where 600 day weight increases so will birth weight.

Heritability
is the term used to describe how strongly a characteristic is transferred from parents to progeny and is rarely considered. It is the proportion of an animal's production that comes from its genetics and varies between traits. The higher the value the faster genetic improvement can be made and positive benefits observed. In general terms, maternal traits are poorly inherited and growth traits are moderate to highly heritable. The detail of such is shown in figure 7.
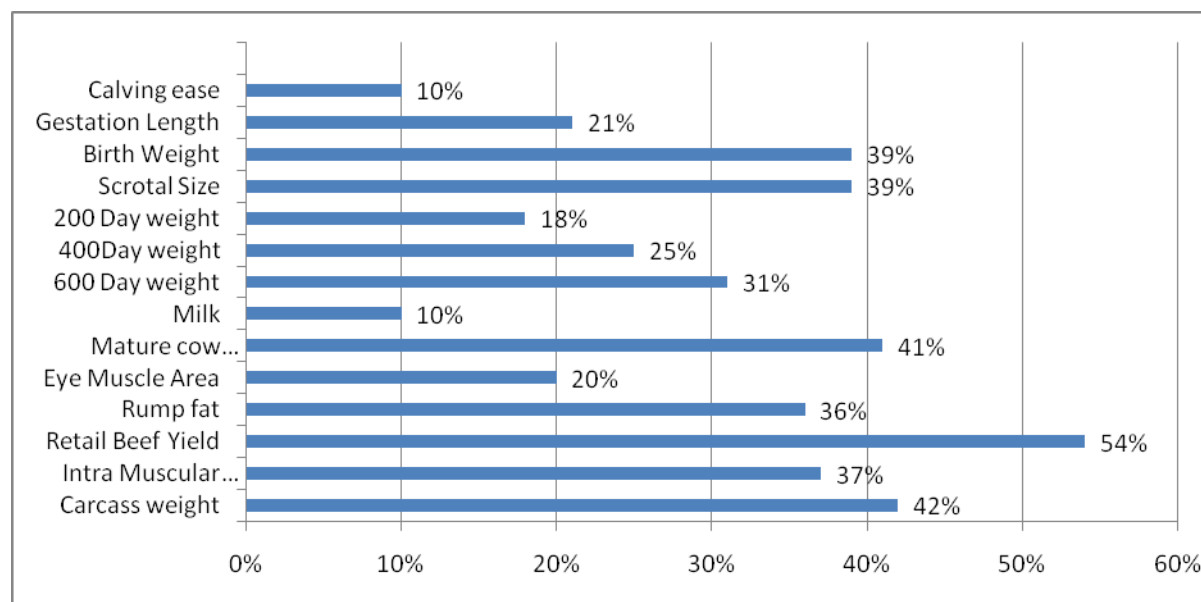
Figure 7 - Heritability of measured traits

The old adage of cattle performance being "80% feeding and 20% breeding" is not strictly true, but the breeding component will determine how the non genetic component is used. At low to average levels of performance, feeding and health will have more of a contribution to an animals overall performance but for those trying to maximise returns the right genetics are vital. A typical example could be milking ability, where if the genetics for milk are poor, feeding will not make a significant difference, the cow will just get fatter.

Accuracy
No two animals are the same, so the more information that can be collected, the more one can account for the variation between individuals, and so the overall risk of using them can be reduced.

EBV data must generally reach a certain level of accuracy before it can be reported to ensure the information is as relevant as possible and truly reflects the potential performance of the animal in question. Some traits such as growth will not be reported until they reach an accuracy level of 40%, which is typically at the lower range of reported accuracies (these can be up to 99%). Traits which are more difficult to measure such as carcass and fertility related can be reported at much lower levels due to the limited information available, requiring the user to make a judgement decision.

Producing good quality EBVs

Records and measurements

Throughout a performance recorded animal's life, measurements are taken which are used to produce its EBVs. These start with a birth weight and calving ease score. These measurements are supplemented by weights at 200 days, 400 days and 600 days as well as scrotal circumference (bulls only) and ultrasonic measurement of back-fat, rump fat and muscle depth. At weaning time, dam weights will also be collected to contribute to the mature weight EBV.

In the future, genomic data may also be incorporated for the difficult-to-measure traits such as carcass and reproductive characteristics. Disposition data is collected by some overseas breeds and a docility EBV produced to measure their temperament based on "flight time". In a study carried out in Australia it was found that "flighty" cattle were gaining 0.4kg/day less than their docile contemporaries, a substantial amount in today's challenging climate. Signet will be launching a docility EBV in 2011, leading the way in the UK.

In addition to the information collected from an individual, the data from siblings and other family members make a contribution. There are many factors involved in the production of quality EBVs but it is useful to mention a few of the factors that lead to poor quality EBVs as well. The most important principle of performance recording is that of grouping the cattle together for the comparison. This is the biggest challenge for the system to overcome and depends on accurate record keeping and submission of raw data.

Where the same sire is used on the same cows year after year or where there is only a small number in the management group there is evidently a lack of genetic diversity. This limits the amount of variation that can be accounted for.

Management for better quality EBVs

To produce good quality EBVs it is important that the herd has a compact calving pattern, with the cows run in reasonably large groups and that any data from that group is collected on the same day. Within this group at least two different sires should be used each year to allow the system to compare the performance levels between these sires' calves. Ideally the bulls should be a mix of a proven sire and a young or unproven sire from the recorded animal itself. This information depicts the type of genetics that an individual actually possess because it helps estimate the genetics that it will pass to its progeny.

Any animal that may have been sick, fed for a show or sale, used as a sire or introduced to a new group should be identified to ensure it is not compared on a "like for like" basis with the rest of its group.

In small herds the use of AI bulls will lead to rapid improvements in their EBVs and accuracy. This applies to all sizes of herds. In small herds the risk may be to use a bull retained from the herd. His use is limited to only a small number of females each year meaning the chance of getting any meaningful information is negligible. Small herd owners need to evaluate the cost of keeping a bull compared to AI, given modern heat synchronisation techniques which make the process much simpler and more accurate.

The main principle must be to record all calves, the good the bad and the ugly. Selectively recording animals will deny a true picture of what is happening in the herd. It will give a distorted base set unreasonably high or it may undervalue better sires whilst overvaluing lesser sires.

Accuracy in measuring weights and correctly recording dates of birth can make a substantial difference. Estimating weights is not accurate enough and whilst not having a significant effect on the overall group (as the estimate will likely be variable), 50kgs of error either way can have a much more serious impact on the individual, adversely affecting related traits especially those with negative relationships. Accurate honest weights are vital to many processes on farm including medical treatments and pre sale checks. A weigh scale is the most important piece of equipment on a livestock farm.

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

Popular misconceptions

It is often asked why a good animal does not have good EBVs, or vice versa:

- Firstly an EBV is a performance estimate or prediction for the progeny of a bull or cow and **not** of their own performance.

- Secondly the animal will most likely have had its environment influenced in some way. It may have been taken away from the rest of its group, been suckling another or several other cows, had creep feed, been housed earlier or weaned later or some other such practice which has compensated for its lack of genetic potential.

Below are two of the reasons why some cattle look outstanding but their EBVs do not reflect this. The questions which should be asked at this stage are "What would this animal have looked like without additional management?" and "What will his calves look like without similar expensive management?"

- Where a calf with superior genetics suffers a setback such as disease affecting it or its mother, the opposite effect can occur. This animal still has all the potential and genetics to produce great progeny but may not look as good as it could or as good as its contemporaries. This highlights the danger of selecting by eye alone, as this animal could be inadvertently rejected.

- Animals that have been imported from overseas can suffer from poor, low accuracy EBVs. With limited or no information about its past performance, its EBVs will unfortunately reflect this until sufficient data is collected and processed, in its new home country.

Concern is often expressed about the possibility of a person exaggerating the weight of an animal to increase its EBV. This could happen but it would be unwise.

There are checks and balances within the EBV system which queries animals that are too far ahead of the group and secondly, as progeny are analysed its failure to perform to expectations will be noticeable. Animals that are outside the boundaries are flagged as "outliers" for further investigation.

Anyone under the illusion that he can beat the system and fool the process is wrong. He may get away with it for one or two calf crops but the cattle will fail to live up to their expectations with their EBVs deteriorating rapidly when they go into production. The biggest victim in this fraud is the person recording the data as he is fooling himself and destroying his reputation. Breed societies need to act aggressively in any cases detected to protect their members and the integrity of the breed.

Selection indexes

Selection indexes take the hard work out of knowing how much emphasis should be placed on each of the available EBVs when making breeding decisions. An index gives a single EBV that reflects the value of an animal in financial terms.

Indexes allow balanced selection as they apportion the amount of selection pressure that needs to be applied for growth, maternal, carcass and fertility traits to give the most profitable herd over the long term. Typical production parameters, prices and production costs underlie each index.

The next part involves steps that combine economics with genetics. Financial values for performance measures are calculated for each breed's production and market. Using genetic theory these financial values are used to calculate appropriate weightings for the EBVs currently available.

Indices exist for different markets such as terminal index and self replacing index (see appendix 3) and provide a convenient way of speeding up a search. Choosing the highest index animal will not necessarily result in a suite of traits that will suit the herd and compromise will likely be needed so it is still essential to look at the EBV for each trait and determine if they are appropriate to ultimately satisfy the previously identified needs.

How much is genetic improvement worth?
At this point it is worth using an example to show how value can be calculated using EBV data. As already mentioned Indexes are a financial value. Using the example of Dorepoll 1 10H Headliner (appendix 2) who has a Self Replacing Index (SRI) of £36.00 compared to the breed average of £24.00, there is a difference of £12.00. In a herd producing 100 calves over his breeding lifetime this equates to £1200. Compare this bull to a bull with a self replacing index of £10 and the extra value to the business immediately leaps to £2600!

Irish Cattle Breeders Federation
The Irish Cattle Breeders Federation (ICBF) has developed a product named "Herdplus". This system produces management reports for both the pedigree and commercial herd owners. EBVs and indexes are also produced for both types of herd meaning that even commercial suckler cow herds have performance recording information available for all their cattle. The system draws on information from markets, abattoirs and data collected by the farmer. Hopefully the UK will be able to develop a similar system in the years to come.

12. DNA BASED TECHNOLOGIES

DNA is found in every living cell, in every living thing on the planet and is made up of pairs of four nucleotide bases (amino acids) abbreviated to "A","C", "G" and "T". These bases pair up as A&T and C&G and are known, conveniently, as base pairs. The entire genetic makeup or genome of an animal is stored in chromosomes located within the cell. DNA has two functions, to transmit genetic information during reproduction and secondly to continually spell out the identity and rate of assembly of proteins which are essential to the structure and function of an animal.

A gene is the sequence of DNA that contains all the instructions for making a protein and resulting living organism. It is possible for DNA sequences to differ between individuals and result in different levels and types of protein being produced leading to animals that look and perform differently.

The science used is known as genomics. It is a very young science, where the knowledge, techniques, technology and skills are being created and learnt as demand increases. Recently scientists have started to identify regions of DNA that influence performance and production traits. They look for differences in the DNA sequences in these regions.

The latest method used is referred to as single nucleotide polymorphism or SNP (pronounced "snip") and focuses on detecting precise SNP base pair differences (where A&T and C&G are swapped at a particular point in the sequence) (figure 9) amongst the three billion base pairs that make up the bovine genome. Most of the economically relevant traits for cattle production are complex traits which are controlled by many genes in addition to the influences from the environment.
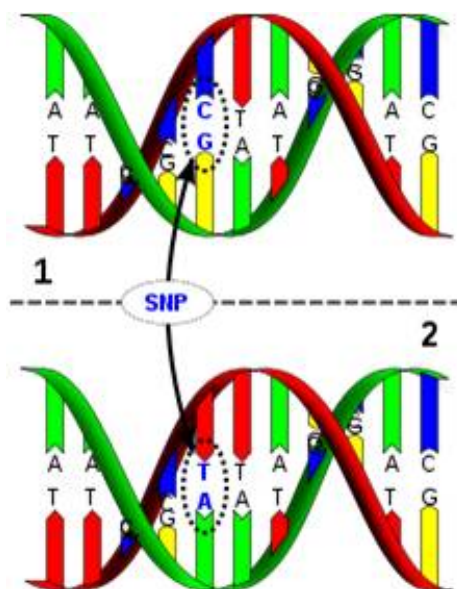
Figure 9: A "SNP" in the DNA double helix

It is important to re-emphasise that this is a very young science and there much to be learned. Whilst the bovine genome has been mapped the challenge still remains to identify what each SNP controls and influences and if that variation has the same effect in different breeds and populations. Collecting performance information has

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

never been more important and anyone thinking of dispensing with the weigh scale will be disappointed!

As more discovery and analysis is carried out our understanding will improve and scientists will gain a more thorough understanding of their function. As it stands, the tests currently available account for a reasonable amount of genetic variation as far as current knowledge extends. It is not known however exactly how many genes affect the many traits that make cattle what they are and we are still learning how genes interact with each other and function together.

Picture 4: L1 Dominette
the DNA donor for the bovine genome mapping project and her calf

Gene markers have various uses in cattle production including parentage verification, genetic defect identification but for the purpose of this report I have dealt with two aspects:

- **Marker Assisted Selection (MAS)**

- **Marker Assisted Management (MAM)**

Marker Assisted Selection (MAS) is the process of using the results of SNP marker tests to identify traits of interest and aid in the selection of individuals that will become the parents of the next generation. Their greatest use comes with traits that have a low heritability, are difficult to measure, cannot be measured until the animal has produced progeny (by which time it may be too late), where the animal may have to be slaughtered or where the trait is not routinely measured.

The characteristics in question include carcass and eating quality characteristics, fertility and reproductive traits, milk production, maternal ability and feed efficiency. This is a very brief summary of what is currently available as the technology is constantly evolving. There is a tremendous amount of research being carried out in the USA developing new tests especially in the areas of meat eating quality, feed efficiency and animal health.

These tests are based on panels of SNPs. Once again, as technology has been developed, the capacity of the SNP chip (the test equipment) has regularly increased to 50K, 100K and beyond with a 1Million SNP on the horizon. The more SNP's the better the accuracy of the information produced. There is unfortunately a cost involved.

MAS has potential use in both the pedigree and commercial beef herds. The ultimate outcome for DNA based information in the pedigree herd will be when it can be incorporated into EBVs and used as an information harvesting tool just as a weighbridge or ultrasound scanner is used today. We are some way off this in the UK but the American Angus Association has already started to incorporate genomic data for some of their carcass EPDs with the American Hereford Association soon to follow suit.

Genomic information can be used in its "raw" format with the main test providers offering online comparison and benchmarking software.

Commercial herds may see the biggest advantage as they have little or no knowledge of their herd's genetic composition. In the absence of EBVs, DNA information can give a comprehensive suite of traits directly related to maternal productivity, carcass traits and feed efficiency. In this case it is important to use weights etc to back up the information.

Marker Assisted Management (MAM) is slightly different to MAS. The principle is to use a small number of SNPs to measure specific traits. Their use is focused on the feeding sector where cattle can be sorted into various streams for traits such as propensity for marbling, maturity stage, back fat and feed efficiency to name but a few. This means that cattle can be targeted to specific management regimes or market outcomes.

For the purpose of genetic improvement MAS has more relevance.

The over-arching question that must be asked before using DNA markers is, "What is the benefit and how can the costs be recovered or justified?" If the trait can be measured using conventional performance recording there is no need to use anything else. If there is no other method of measuring a trait, cost is not prohibitive and it is a benefit to the business, it may be worth considering genomic analysis as part of a comprehensively designed plan.

13. SELECTIVE CULLING

With all the tools and a comprehensive package of information on every aspect of the herd's physical, financial and aspirational performance, the next step should be to apply this to the herd. A consequence might be selective culling. Culling may be for two reasons; either an animal is no longer productive or because it is inferior in actual or potential production, and is holding back progress. The severity of application is dependent on the numbers in the herd, progress required, severity of "non-conformance" and the number needing to be culled! It is not a straightforward process so, whilst it would be tempting to remove everything that does not conform with the new targets, it may be financially crippling and could damage the structure of the herd for years to come.

It is best to start with obvious faults that are undermining fundamental characteristics such as fertility, calving difficulties, udder quality and foot/leg problems. Although these are obvious points they are widely overlooked and can make a considerable difference to a herd's bottom line profit.

14. VISUAL SCORING

As an aid to culling and in conjunction with the processes I have already mentioned, visual scoring systems can be developed to measure characteristics within the herd that are undesirable. These are relatively easy to create requiring no more than a knowledge of what good and bad look like and allocating a score to those points and the variation in between.

Scoring is typically done on a scale of 1-5. The main characteristics are legs, feet, udder and teats. Legs and feet can be assessed at any time but udder and teats should be scored at calving as this is when poor attachment and teats have the most influence on the new born calf, potentially restricting its ability to consume colostrum. The same principles can be used to measure temperament or any other characteristic needing attention.

Scoring for management purposes, such as condition and frame scoring, is a different principle and I have explained these individually.

Condition scoring is not just a management tool but can be used as a selection tool. Cattle that struggle to carry condition, or carry too much, need to be identified for short time correction and long term adaption. Whilst fat may be considered wasteful, it serves as an important energy store to see breeding stock through times when their diet may be deficient (in energy). Condition is important post calving to protect milk production and ensure the cow rebreeds quickly. Likewise, bulls that have a concentrated period of work need sufficient fat cover to keep them working during this intense period. It is equally important to ensure that animals do not carry too much condition which can reduce fertility in both sexes and is a waste of resources and money.

Information and advice on condition scoring is available from levy bodies and agricultural colleges.

Frame scoring is a means of determining if an animal has enough "frame" for its age allowing for comparison within and between herds. Whilst this has been common practice in many pedigree herds it has not been widely used in commercial herds. It is a convenient way of determining if heifers are large enough to breed, as an example where the frame score can be related to a weight. A chart is included in Appendix 1 showing where it is measured and charts for its calculation.

15. CONCLUSIONS

1. We have become so busy treating the solutions that we have forgotten what the problems are.

2. We have grown to accept faults in our cattle that are fundamentally wrong and compensate for these with time and resources that we cannot justify.

3. Every farm business is different and should decide what systems suit their circumstances and adopt them.

4. We have been trying to make our farms fit the system, instead of the system fit the farm.

5. When selecting bulls set EBV targets first then look at the bulls. Stick to the targets!

6. We need to resist the temptation of comparing breeds and start to think of them as packages of traits, the most suitable of which is the one that has the characteristics needed on that particular farm, irrelevant of coat colour.

7. The responsibility for genetic/performance improvement in the beef herd does not lie solely with cattle producers, but with the whole supply chain.

8. The lack of shared information is restricting producers' ability to supply what the retailer and consumer demand because they simply do not know what is required.

9. Our out-dated carcass classification system is restricting our ability to change our production systems and adapt to modern consumer demands by sending out poor market signals.

10. There are many misguided lifestyle and "hobby" farmers breeding cattle, without any knowledge of their purpose. Many of our specialised native breeds are being destroyed by their actions.

11. Livestock shows have taken on a beauty pageant role and are encouraging the production of commercial cattle that are not needed or wanted by processors or retailers and cause gross inefficiencies on farm.

12. Popular marketing strategy : Fad x Publicity = Fact! (*Steve Radakovich 2009)*

16. RECOMMENDATIONS

It is in the best interests of the entire supply chains to see performance improvement in the beef herd. My recommendations with suggestions for each supply chain partner follow this principle. Whilst some of these recommendations may not have been explored in my report, they are vital in a wider aspect and necessary if a profitable and sustainable National suckler herd is to be achieved.

Beef industry

1. An increase in levies collected to fund research, product development, marketing and industry development, independent of government.

2. Uniting of the regional levy bodies (EBLEX, HCC, QMS and LMC), streamlining marketing, co-ordinating research and producing a consistent messages to consumers' and KTT to producers.

3. Development of across breed EBVs or across breed correction factors based on breed averages, e.g. the breed average birth weight for a Hereford and Charolais will be extremely different but they are still on the 50th percentile in their own breeds

4. Establishment of UK based genomic test validation group.

5. Classes for performance recorded cattle at shows that are more than a token gesture, using EBVs in equal measure to visual appraisal.

Breed Societies

6. Societies need to focus on the roll of their breed, commissioning research and promotion into relevant current markets and move away from the image of show organisers and social clubs.

7. Breed societies must offer training and guidance to new members to ensure they understand the purpose of their cattle and that they have the skills to manage them.

8. Tougher inspections at pedigree sales to eliminate structurally unsound cattle. Only cattle with EBVs should be eligible for society sales.

9. Protect the integrity of the breed and create a fair position for all breeders by taking a tougher attitude towards accurate data collection.

10. Society council membership should not be "a job for life". There needs to be a turn-over of members to bring new ideas and progress the aims of the society and breed.

Pedigree breeder

11. Adopt a balanced approach to breeding decisions not focusing too strongly on one trait alone.

12. Identify what buyers need and expect.

13. Produce an animal which will be with its new owner for several seasons. Its management and development need to follow principles that ensure longevity.

14. Cull vigorously anything that does not come up to the standards expected or develops problems that will turn it into a liability instead of an asset.

15. Communicate with customers about how the cattle they have purchased perform and especially if expectations have been met.

16. Use young sires alongside proven sires within the herd to improve the accuracy of EBVs (appendix 4).

17. The use of AI will improve the accuracy of EBVs by increasing the number of siblings produced as well as allowing for the use of bulls that could not otherwise be accessed.

Commercial breeder

18. Identify the markets that can supply with existing resources.

19. Change buying practices and seek out quality, performance recorded bulls that will fulfil their requirements rather than the "calf-getter" mentality.

20. Base breeding systems on those that make money not cost money. Do not get carried away with vanity that may yield a large price but not necessarily a profit.

21. Ensure the breeding stock purchased come from a breeder who does things the way you do. Do not buy fat, over-fed bulls and expect them to serve too many cows. They are not prepared for this and will break down resulting in a poor calf crop, barren cows and a wasted investment (appendix 4).

22. The breeding stock bought should have been developed and managed carefully. Treat it like the asset it is and follow the advice the breeder should have given at purchase indicating how to take care of them cattle over the first few weeks at their new home.

23. Buy bulls or semen well in advance of the breeding season. This gives plenty of time to shop around and see what is available, making sure one is buying what is need and not being restricted with what is available at the last minute.

24. It is essential that bulls are acclimatised to the farm, arriving in plenty of time to be isolated and prepared for the breeding season.

25. Pedigree breeders can produce what the customer wants, but is this what the customer needs?

26. Breed cattle that will make life easier.

Feeder

27. Monitor the growth rates of your cattle and record them.

28. Feed back to suppliers about how the cattle have performed.

29. Note who supplies you the best performing and most profitable cattle so you can buy from them again.

30. Note who supplies you the worst performing and least profitable cattle so you can avoid buying from them again!

Processor

31. Co-operate In the creation of better communication throughout the supply chain.

32. Work with your suppliers in developing sensible approaches to challenges you encounter.

33. One of the factors restricting the profitability of beef production in the UK is the EUROP grading structure. It is encouraging inefficient production systems on farm and a product which frequently fails the consumer. In the short term a restructuring of payments would send out a clear message about what best suits your customers. For example when in a recession with higher demands for forequarter and manufacturing meat an increase in the price paid for R and O grades, can ensure cattle supplies better fit the required market.

34. Adoption of carcass Video Image Analysis grading (VIA) making carcass grading more consistent and accurate.

35. The development of systems that measure meat eating quality and payment structures based on them.

17. WHAT NOW FOR ME?

Since completing my travels I have returned home to contemplate and question many of the practices commonly carried out on beef farms throughout the UK. We have the best climate and conditions in the world to produce a safe and wholesome food but lack the willingness to change some of our production methods.

Through my association with the National Beef Association (NBA) I have had the opportunity to speak to groups of producers on many occasions, sharing my perspective and hopefully encouraging them to ask the same questions of themselves that I have of myself.

I have recently taken the chairmanship of the Sustainable Livestock Systems and Supply Chain sub-group of the Northern Ireland Red Meat Stakeholders' Forum. This group is investigating systems that can be developed on farm to improve the efficiency and profitability of Northern Irish beef and sheep farms. I also represent the NBA on the development group establishing CAFRE's Abbey Farm as a demonstration farm where "best practices" are being put into action so that farmers can come and see the decisions in practice. My Nuffield scholarship has given me the knowledge to comfortably take an active role in the future of the Northern Ireland and UK beef industry and given me a voice amongst policy makers that I did not have pre Nuffield.

Changes are also taking place within our own herds. We are adopting new management strategies for both the pedigree and commercial cow herds and placing much more consideration on performance recording, customer care and marketing of our genetics. We will be using the commercial herd to prove our pedigree herd's capabilities and I hope to set up a sire referencing project if I can find willing participants.

Unfortunately, some of the practices we need to adopt to be better breeders and to do what is right for the industry would not be accepted by the industry in its current state. These will probably have to wait until the market is ready for commercially reality instead of "vanity insanity"!

I plan to develop a market for the excess females from the commercial herd as specialist suckler herd replacements, bred specifically for that purpose. In the longer term future I would like to establish a relationship with meat processors to supply designer genetics to capitalise on current and future premium markets.

William Haire NSch

41 Divis Road
Crumlin
Co. Antrim
Northern Ireland BT29 4UB
Tel : 028 908 25215
Email : williamrhaire@hotmail.com
Mobile : 07725 653233
www.dorepollherefords.co.uk

41

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

18. THANKS

I have been fortunate to find many like minded people throughout my journey who are happy to question convention and seek new ways to achieve their goals. They have been both challenging and inspirational to me throughout my study and beyond. My sincere thanks to everyone who advised, hosted, arranged, planned and put up with me throughout my study!

United Kingdom
Miss Sarah Long NSch
Mr Charley Walker NSch
Mr Ciaran Hamill NSch
Mr Sam Boon NSch
Mr Huw Davies NSch
Dr Norman Weatherup, CAFRE Northern Ireland
Dr Stephen Johnston, CAFRE Northern Ireland
Mr and Mrs John Cameron, Balbuthie, Fife
Dr Tim Roughsedge, SAC Edinburgh
Dr Mike Coffey, SAC Edinburgh
Dr Huw Jones, Genesis Faraday Edinburgh
Mr Nick Munce, Igenity UK

United States of America
Mr Jim Tait and colleagues, Igenity, Duluth, Georgia
Pharo Cattle Co, Cheyeene Wells, Colorado
Mr Warren Weibert and Mr Kevin Unger, Decateur County Feedyard, Oberlin, Kansas
Dr Patsy Houghton and Dr Janet Rippe, Heartland Cattle Co. McCook, Nebraska
The Uden family, TC Ranch, Franklin, Nebraska
The Jensen Family, Courltand, Kansas,
Mr Scott Opbroek and colleagues, US MARC, Clay Centre, Nebraska
Dr Ronnie Green, Pfizer Animal Genetics
Dr Matt Spangler and Dr Rick Rasby, University of Nebraska, Lincoln, Nebraska
Mr and Mrs Steve and Penny Radakovich, Radakovich Cattle Co, Earlham, Iowa
Pioneer Hybrids, Des Moines, Iowa
Dr Jim Reecy, Iowa State University, Ames, Iowa
Mr Craig Huffines and colleagues, American Hereford Association. Kansas City, Missouri
Circle A Ranches, Huntsville, Missouri
Mr and Mrs Ben and Darla Eggers, Sydenstricker Genetics, Mexico, Missouri
Mr Bill Bowman, Dr Sally Northcut and colleagues, American Angus Assoc, St Joseph, MO
The Schultz Family, Sandhill Farms, Haviland, Kansas
Mrs Hope Pjesky, Eisenhower Fellow, Oklahoma
Mrs Heather Buckmeister, Oklahoma Beef Council, Oklahoma City, OK
Mr Ben Hale, Western Livestock commission Co, Oklahoma City, OK
Oklahoma State University, Agriculture Faculty, Stillwater, Oklahoma
Dr Bob Wetterman OSU, Stillwater, Oklahoma
Mr Shan Ingram and colleagues, Nobel foundation, Ardmore, Oklahoma
Pollard Farms, Enid, OK
Dr Mark Enns, Colorado State University, Fort Collins, Colorado
Leachman of Colorado, Wellington, Colorado

Dr Tom Ford and Colleagues, National Cattlemans Beef Association, Centennial, Colorado

New Zealand
Mr Alec Jack NSch
Mr James Parsons NSch
Miss Mandy McLeod NSch
Mrs Jan Wills, World Hereford Council, Matamata
Mr Russell Priest, Meat and Wool NZ, Fielding
Dr Chris Morris, Agrisearch NZ, Hamilton
Dr Duncan Smeaton, Agrisearch NZ, Hamilton
Mr Allan McPherson, LIC, Hamilton NZ
Dr Steve Morris, Massey University, Palmerston North
Dr John Rendel, Landcorp, Wellington
Mr Roger Bedford, Landcorp, Waikite
The Morrisons, Ardo Herefords/Eazicalve, Marton and Ratanui
Mr John Absolom and Dr Aimee Charteris, Rissington Breedline, Napier, Hawkes Bay
The Chestermans, Koanui Poll Herefords, Havelock North
The staff at Meat and Wool NZ HQ, Wellington

Australia
Mr Jim Geltch NSch
Mr Rob Kelly NSch
Miss Julie Brien NSch
Mr Stuart Barden NSch
Dr Ian Purvis and colleagues, CSIRO FD McMaster Laboratory, Armidale, NSW
Dr Hans Grazer and Dr David Johnston, AGBU, University of New England, Armidale, NSW
Dr Wayne Upton, AGBU, UNE Armidale, NSW
Prof. Julius Van der Werf, Dept of Animal Science, UNE, Armidale
Mr Jack Allen, ABRI, UNE Armidale, NSW
Dr Paul Greenwood and colleagues, NSW, DPI, Armidale, NSW
Mr Bob Freer, Amtek pty, Armidale, NSW
Dr Tom Johnston UNE, Armidale, NSW
Mrs Alison Betts, Beef CRC, Armidale, NSW
Dr Peter Parnell and Mr Carel Teseling, Angus Association of Australia, Armidale, NSW
Mr Matt Monk Sundown Pastoral Co, Kingstown, NSW
Yalgoo Poll Hereford stud, Walcha, NSW
Bowen Poll Hereford Stud, Barraba, NSW
Kidman Cattle Co., Dubbo, NSW
Brian and Lucinda Corrigan, Rennylea Angus, Holbrook, NSW
Lawson Angus, Yea, Victoria

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

Special thanks to:-

My family for looking after the farm and herds whilst I was travelling and report writing.

The Nuffield Farming Scholarship Trust and my sponsors the Thomas Henry Foundation.

Sarah Long for her moral support during my study and for proof reading my report.

Sam Boon for proof reading my report and his technical advice.

James Laffin for proof reading my report.

The Latimer family. Remitall Cattle Co. Alberta, Canada. Although I did not visit the Latimers during my study I have spent a lot of time with them over the past ten years. They have had a considerable influence on my agricultural career and the Dorepoll herd's success as a result of the principles and practices I have learnt from them. I would like to thank them for their friendship and making me feel part of the family.

I would particularly like to mention Louis Latimer, a gentleman, revolutionary cattleman and friend whose stories and achievements have been an inspiration to me. If I can achieve a fraction of the things in my lifetime that he has in his I will far exceed my own expectations.

Steve and Penny Radakovich, for their wonderful hospitality and unique perspective on cattle breeding, challenging me to look at cattle production from beyond convention and not to passively accept someone else's opinion is correct! "Fad X Publicity^2=Fact"

Hope Pjesky for giving up your time so freely and organising a programme I could never have, and some of the most exciting visits during my study.

Russell Priest for organising a great programme for me and putting up with my driving! His no-nonsense explanation of what can be a challenging subject has helped me understand what is really needed on farm.

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

Appendix 1: Frame scoring

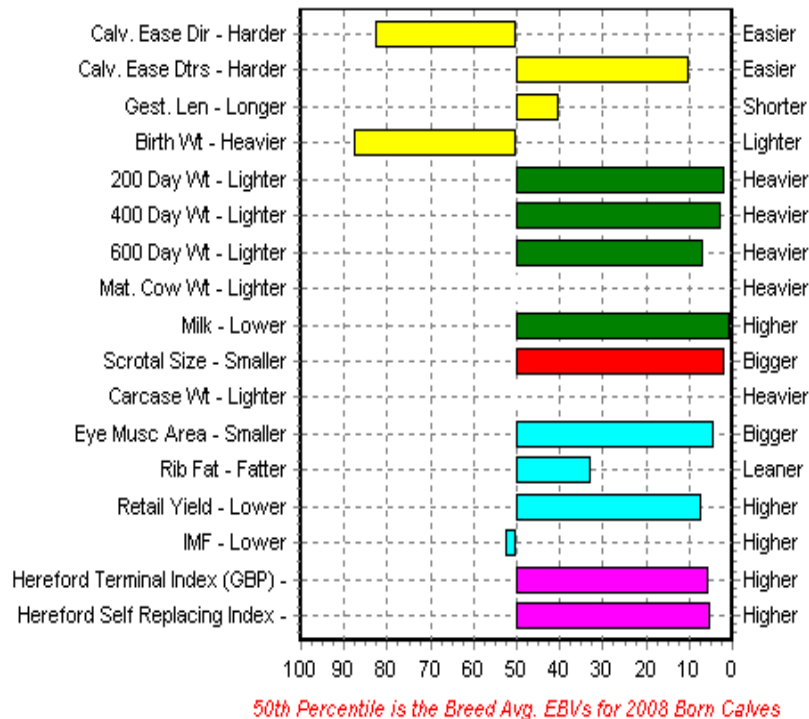| BULL FRAME SCORE CHART				
AGE	Frame Score (Height over hips - cms)			
	4	5	6	7
9	112	117	122	127
10	114	119	124	130
11	117	122	127	132
12	119	124	130	135
13	121	126	131	136
14	122	127	132	137
15	123	128	133	138
16	124	130	135	140
17	126	131	136	141
18	127	132	137	142
19-20	128	133	138	143
21-22	129	134	139	144
23	130	135	140	145
24	131	136	141	146
Mature	135	140	145	150

FEMALE FRAME SCORE CHART				
AGE	Frame Score (Height over hips - cms)			
Months	4	5	6	7
9	108	113	118	123
10	110	115	120	125
11	112	117	122	127
12	114	119	124	129
13	116	121	126	131
14	117	122	127	132
15	118.5	123.5	128.5	133.5
16	120	125	130	135
17	121	126	131	136
18	122	127	132	137
24	125	130	135	140
Mature Frame Score if:				
Calved 2yrs	127	132	137	142
Calved 3 yrs	129	134	139	144

Hip Height

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire
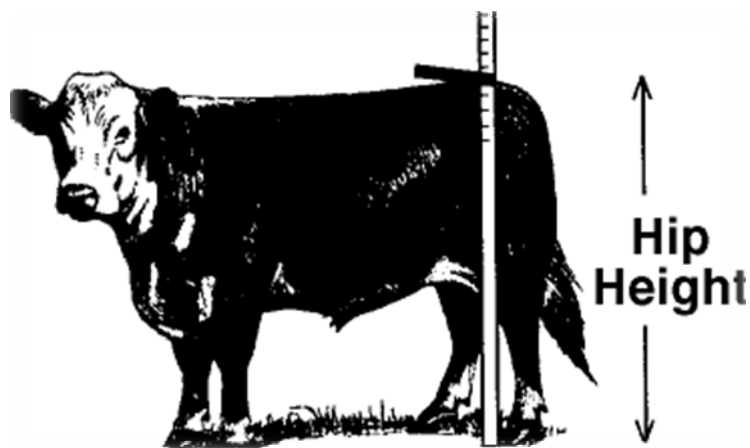
Appendix 2: Breedplan EBV

EBV Percentiles for Dorepoll 1 10H Headliner (S) AI

50th Percentile is the Breed Avg. EBVs for 2008 Born Calves

2010 Summer Hereford BREEDPLAN EBVs

	Calv. Ease Direct (%)	Calv. Ease Dtrs (%)	Gest. Len. (days)	Birth Wt. (kg)	200 Day Wt. (kg)	400 Day Wt. (kg)	600 Day Wt. (kg)	Mat. Cow Wt. (kg)	Milk (kg)	Scrotal Size (cm)	Carcase Wt. (kg)	Eye Muscle Area (sq.cm)	Rib Fat (mm)	Retail Beef Yield (%)	IMF %
EBV	-2.0	+1.6	+0.6	+3.2	**+35**	+62	+74	-	+11	+1.4	-	+2.3	-0.3	+0.8	-0.1
Acc	56%	48%	69%	85%	77%	74%	75%	-	54%	54%	-	33%	40%	38%	38%
Breed Avg. EBVs for 2008 Born Calves Click for Percentiles															
EBV	+0.3	-1.2	+0.8	+1.7	+23	+41	+52	+51	+3	+0.3	+32	+1.2	-0.2	+0.2	-0.1

Traits Observed: BWT

Statistics: Number of Herds: **15**, Progeny Analysed: **61**, Scan Progeny: **7**, Number of Dtrs: **6**

Hide Index Values

SELECTION INDEX VALUES

Market Target	Index Value	Breed Average
Hereford Terminal Index (GBP)	+30	+20
Hereford Self Replacing Index	+36	+24

46

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire

Appendix 3: EBV descriptions

CE % Direct = Direct Calving Ease - The EBV for direct calving ease indicates the influence of the sire on calving ease in purebred females calving at two years of age. *High negatives mean more difficult calving whilst high positives are easy calving.*

CE % Daughters = Daughters' Calving Ease - The EBV for daughters' calving ease indicates how easily that sire's daughters will calve at two years of age. This is an important trait if you are breeding your own replacements.

Again, high negatives are more difficult whilst high positives are easier.

Gestation Length EBV (days) is an estimate of the time from conception to the birth of the calf.

Lower (negative) GL EBVs indicate shorter gestation length and therefore a tendency for easier calving and increased growth after birth.

Birth Weight EBV (kg) is based on the measured birth weight of progeny, adjusted for dam age.

The lower the value, the lighter the calf at birth and the lower the likelihood of a difficult birth. *This is particularly important when selecting sires for use over heifers.*

200-Day Growth EBV (kg) is calculated from the weight of progeny taken between 80 and 300 days of age. Values are adjusted to 200 days and for age of dam.

This EBV is the best single estimate of an animal's genetic merit for growth to early ages.

400-Day Weight EBV (kg) is calculated from the weight of progeny taken between 301 and 500 days of age, adjusted to 400 days and for age of dam.

This EBV is the best single estimate of an animal's genetic merit for yearling weight.

600-Day Weight EBV (kg) is calculated from the weight of progeny taken between 501 and 900 days of age, adjusted to 600 days and for age of dam.

This EBV is the best single estimate of an animal's genetic merit for growth beyond yearling age.

Mature Cow Weight EBV (kg) is based on the cow weight when the calf is weighed for 200 days, adjusted to 5 years of age.

This EBV is an estimate of the genetic difference in cow weight at 5 years of age and is an indicator of growth at later ages and potential feed maintenance requirements of the females in the breeding herd. Smaller or more moderate EBVs give cows with lower maintenance costs.

Milk EBV (kg) is an estimate of an animal's milking ability.

For sires, this EBV indicates the effect of the daughter's milking ability, inherited from the sire, on the 200-day weights of her calves. For dams, it indicates her own milking ability.

Scrotal Size EBV (cm) is calculated from the circumference of the scrotum taken between 300 and 700 days of age and adjusted to 400 days of age and is an indicator of male fertility in regards to semen quality and quantity.

There is also a small negative correlation with age of puberty in female progeny i.e. the daughters of bulls with larger testicles may come into season at an earlier age. *Higher (positive) EBVs indicate higher fertility.*

Carcass Weight EBV (kg) is based on abattoir carcass records and is an indicator of the genetic differences in carcass weight at the standard age of 650 days. *An important trait for finished cattle production*

Eye Muscle Area EBV (sq cm) is calculated from measurements from live animal ultrasound scans and from abattoir carcass data, adjusted to a standard 300 kg carcass.

This EBV estimates genetic differences in eye muscle area at the 12/13th rib site of a 300 kg dressed carcass. More positive EBVs indicate better muscling on animals. Sires with relatively higher EMA EBVs are expected to produce better muscled and higher percentage yielding progeny at the same carcass weight than will sires with lower EMA EBVs.

Fat EBV (mm) are calculated from measurements of subcutaneous fat depth at the rib (from live animal ultrasound scans and from abattoir carcasss) and are adjusted to a standard 300 kg carcass.

This EBV indicates the genetic difference in fat distribution on a standard 300 kg carcass. Sires with a low, or negative, fat EBV are expected to produce leaner progeny at any particular carcass weight than will sires with higher EBVs. In breeding females a positive value may be important as fat is an important energy store.

Retail Beef Yield EBV (%) indicates genetic differences between animals for retail yield percentage in a standard 300 kg carcass.

Sires with larger EBVs are expected to produce progeny with higher yielding carcasss. This is an important trait in finished steers and heifers.

Intramuscular Fat EBV (%) is an estimate of the genetic difference in the percentage of intramuscular fat at the 12/13th rib site in a 300 kg carcass.

Depending on market targets, larger more positive values are generally more favourable.

Terminal Sire Index
The Terminal Sire Index is a combination of growth and carcass trait EBVs into a single figure and is a measure of a bull's ability to produce prime steers and heifers for the finished market. When using a bull on cross bred cows you should consider placing extra emphasis on the Calving Ease Direct EBVs (more positive) of the sire to allow for possible heavier birth weights of his calves due to hybrid vigour.

The higher the Terminal Index then the progeny mature at an earlier age and at a heavier weight.

Self Replacing Index
The Self Replacing Index is used when selecting replacement females from within the herd while finishing steers and surplus heifers at 18 - 20 months of age. There is emphasis on Calving Ease Daughters (Dtrs) and maternal traits but also including some growth trait EBVs. Again when using a bull on cross bred cows you should consider placing extra emphasis on the Calving Ease Direct EBVs (more positive) of the sire to allow for possible heavier birth weights of his calves due to hybrid vigour.

The higher the Self Replacing Index then the female progeny will make better herd replacements.
Source: ABRI

Appendix 4: Bull buyers' check list

Top 10 tips for bull selection

1. Disease status of the herd, TB record, vaccination history, CHECS health scheme member.

2. How has he been managed, extensive or intensive? Can you see evidence of this?

3. How is the herd managed?

4. Is the herd run on a commercial basis?

5. What are the herds breeding objectives?

6. Is the herd performance recorded?

7. What are the bulls EBVs?

8. Can the breeder show evidence of genetic progress?

9. What are the breeders main criteria for sire selection?

10. What is the warranty and what are the conditions?

Selection techniques and performance improvement in the suckler herd
A Nuffield Farming Scholarships Trust report by William Haire