Beef Breeding Technology & Practice
In the Suckler Herd

NUFFIELD IRELAND

Farming Scholarships

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INTRODUCTION

My name is Jer Bergin, a farmer in Ballacolla, Co Laois in the midlands of Ireland. I am 37 years old, single, running a mixed farm enterprise consisting of an 80 cow suckler herd with all progeny reared to beef, a 250 head ewe flock again with all flock reared to finish and a small arable section growing wheat, malting barley, sugar beet and maize. My farm consists of 170 acres owned and 100 acres rented and its mixed nature would be typical of farming systems in Co. Laois. The area I come from is heavily dependent on agriculture and agri-related services and industry. I came home to full-time farming in 1984 after completing my Green Certificate in Rockwell Agricultural College. My late father retired in 1987 leaving me in control of the family farm business.

This background has given me a great interest in all things agricultural and as such I have been involved in a number of rural organizations outside the farm gate such as Macra Na Feirme and IFA, serving in the latter organisation at both local and national level. I am currently Vice-Chairman of IFA's National Livestock Committee and also represent Co. Laois on its National Council. It was through these channels that I became aware of the Nuffield Farming Scholarships Trust and the opportunities it could offer.

Because of my background in livestock farming and my activities as a farm representative in this area I decided to attempt a related project – Breeding Technology and Practice in the Suckler Herd. Ireland currently has approximately 1 million suckler beef and 1 million dairy cows. The suckler beef herd has grown rapidly since the early 1900s from about 600,000 head to its current position. Much of this change can be attributed to McSharry reforms of the CAP in 1994, the introduction of milk quotas and the lack of profitability in older beef systems such as summer grazing, winter finishing and calf to beef in the intervening years, problems which were further compounded by the 1996 or 2000 BSE crisis. At this juncture it is important to understand the significance of the beef sector to Irish agriculture and the economy in general. Ireland exports 9 out of every 10 cattle produced in either live or beef form and as such is the largest exporter of beef in the northern hemisphere. Pre-2000 BSE crisis, we exported approximately 400,000 live animals annually to countries such as France, Italy, Spain, Holland and the Lebanon. Beef exports are split roughly 55%/45% between EU and more volatile third world country markets dependent on slowly eroding export refunds. There are approximately 80,000 suckler beef farmers in ROI with an average herd size of just 14 cows. In the context of this background the impetus for this study lies in:

1. The need to improve and upgrade the national suckler herd and reverse the decline in Cattle and carcass quality that has occurred throughout the 1990s. To illustrate, in 1990, 56% of our steers were suitable for the EU markets, achieving gradings of E,U,R 3 and 4L. This figure has fallen to just over 20% in 1999.

2. The need to export more of our beef and cattle to the higher value European markets. This currently stands at 54% but has fallen significantly from over 60% pre BSE.

3. The establishment of an Irish Cattle Breeding Federation.

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AUSTRALIA

1. Introduction

I visited Australia in November 1999 to look at the beef industry in general and two specific areas in particular, namely:

i) Breedplan
ii) Meat Standards Australia (MSA)

While in Australia the three research centres I concentrated on, along with visiting many farms and feedlot stations, were the Tropical Beef Research Centre in Rockhampton, Queensland, The University of New England Research Centres in Armidale, NSW, and Meat Standards Australia in Brisbane.

2. Market Overview

Australia has one of the largest beef industries in the world, producing cattle for both live and beef processing trades. Australian cattle and beef are exported to almost 50 countries worldwide and in many instances compete directly with Irish exports. There are approximately 24 million beef cattle and 9 million beef cows in Australia, with annual slaughterings approaching 7 million and annual live exports averaging over half a million head. The main destination markets are Japan, United States, South Korea and other Asian countries and also North Africa.

3. Breedplan

This is a genetic evaluation system for beef cattle breeders, developed by the Agricultural Business Research Institute (ABRI) at the University of New England, Armidale, NSW. Results area calculated using software developed by the Animal Genetics and Breeding Unit (AGBU), a joint Institute of NSW Agriculture and the University of New England, Armidale.

It claims to offer the potential to accelerate genetic progress in the herd, tighten up breeding operations, improve productivity and increase the price of cattle.
Approximately $1.5 million per annum is invested in maintaining and upgrading the system and it is collaboratively funded by the Australian Government, the Australian beef industry and four of Australia's research organisations to the tune of $70 million for ongoing major meat quality and breeding herd efficiency research projects.

Breedplan uses an advanced genetic evaluation system (i.e. an "animal model" which incorporates multi-trait analysis procedures) to produce Estimated Breeding Values (EBVs) of recorded cattle for a range of traits (e.g. weight gain, carcass, fertility).

Breedplan is integrated with the pedigree systems of many breeds. With the increasing use of artificial breeding, most herds in a breed have genetic links with other herds. This allows across-herd comparisons based on Group Breedplan EBVs and has rapidly become the most widely used system. Within-herd analysis can also be obtained. A tailored selection decision can be made by providing vital information on the key factors that determine profitability such as:-

- Whether a bull's daughters will be good milkers
- Whether daughters will be fertile
- How big calves will be at birth and how they will grow on
- What will be the carcass yield of progeny

3.1 Heritability

In simple terms heritability is the proportion of the genetic superiority or inferiority of an animal that is passed on to its progeny. Heritabilities vary for different traits and breeds, but some commonly used values are shown in the table overleaf:

3.2 Predictions of an Animal's Genetic Merit (EBVs and EPDs)

An animal's breeding value is its genetic merit, half of which will be passed on to its progeny. While we will never know the exact breeding value, for performance traits it is possible to make good estimates. These are called Estimated Breeding Values (EBVs) and they are expressed as the difference between an individual animal's genetics and the genetic base to which the animal is compared. EBVs are reported in the units in which the measurements are taken e.g. kilograms for weight. Thus a value of +12kg for 400-day weight means the animal is genetically superior by 12kg at 400 days compared with the genetic base of the relevant cattle population.

Group Breedplan EBVs are calculated from all relevant information available in a breed's database. The resultant EBVs provide predictions of the animal's genetics on a cross-herd basis. EBVs are the best genetic predictions that modern technology can provide.

An Estimated Progeny Difference (EPD) is the prediction of the genetic merit which an animal transmits on to its progeny. Since calves receive half their genes from each parent, an EPD = ½ EBV. EPDs are used in North America where the weight traits are also usually expressed in pounds (rather than kg).

3.3 EBV Calculation

In a simple situation an EBV can be calculated from the records on an animal's performance, the heritability of the trait and knowledge of the genetic base of the population. For example, if an individual animal weighed say 60kg above the average of its contemporaries at 400 days and no other information was available on the performance of relatives, etc its EBV would be calculated as follows:

Table 2: Calculation of Estimated Breeding Values (EBVs)

Performance	+60kg
Heritability	30%

EBV	60X.3 = +18kg

Source: ABRI, University of New England

In real life the calculations become more as in a Group Breedplan situation they include:

- The animal's own performance
- The performance of all known relatives in all herds
- The relationship between the different traits
- The performance of all herds over all the years of recording

There are literally thousands of calculations that go into producing an EBV for a calf in a large performance recorded population of cattle.

3.4 Available EBVs

Most breeds in Australia currently have, or will soon have, options of recording:

Table 3: List of EBVs

Weight	Fertility	Carcass
Birth Weight (optional)	Scrotal Size	Eye Muscle Area
200-day milk	Days to Calving	Fat thickness
200-day growth	Gestation Length	
400-day weight	Calving ease	
600 –day weight		

Source: Agricultural Business Research Institute, University of New England, Armidale NSW

- Scrotal size EBVs give a measure of a bull's genetic potential for fertility.
- Days to calving is a measure of the time elapsing between mating and calving. It is a measure of female fertility. Scrotal size and days to calving are combined into a multi-trait analysis with the weight trials.
- Gestation length is only available from AI and other hand mating programmes. Bulls from herds with shorter gestation periods often produce lighter calves at birth.
- Calving ease is scored using standard codes and is recorded by those breeders who supervise calving closely.
- Carcass EBVs are calculated mainly from real time ultrasound scans made on live animals to measure fat depth and eye muscle area. Actual carcass information can be input too if available. The EBVs calculated from this data would assist increasing the muscling of cattle while changing fat depth up or down as required for particular markets. Carcass EBVs will be extended in future to measures such as estimated lean meat yield.

Table 4:Brief Description of EBVs

EBV	Description
Calving Ease Direct (%)	Estimates of genetic differences between animals in the ability of their calves from 2 year old heifers to be delivered without assistance.
Calving Ease DTRS (%)	Estimates of genetic differences between animals in the ability of their 2 year old Daughters to calve without assistance
Gestation Length (Days)	Estimates of genetic differences between animals in the number of days from the date of conception to the calf birth date
Birth Wt (Kg)	Estimates of genetic differences in calf birth weight
200-Day Wt (Kg)	Estimates of the genetic differences between animals in liveweight at 200 days of age.
400-Day Wt (Kg)	Estimates of the genetic differences between animals in liveweight at 400 days of age
600-Day Wt (Kg)	Estimates of genetic differences between animals in liveweight at 600 days of age
Mature Cow Weight (Kg)	Estimates of genetic differences between animals in cow weight at 5 years of age
Milk (Kg)	Estimates of genetic differences between animals in milk production, expressed as a variation in 200-day weight of daughter's calves
Scrotal Size (Cm)	Estimates of genetic differences between animals in scrotal circumference at 400 days of age.
Days to calving	Estimates of genetic differences in female fertility, expressed as the number of days from the start of the joining period until subsequent calving.
Carcass Weight (Kg)	Estimates of genetic differences between animals in carcass weight, adjusted to 650 days of age
Eye Muscle Area (Cm^2)	Estimates of genetic differences between animals in eye muscle area at the $12/13^{th}$ rib site, in a 300kg carcass
Rib Fat (mm)	Estimates of genetic differences between animals in fat depth at the $12/13^{th}$ rib site, in a 300 kg carcass
Rump Fat (mm)	Estimates of genetic differences between animals in fat depth at the P8 rump site, in a 300kg carcass
Retail Beef Yield % (RBY%)	Estimates of genetic differences between animals in percentage retail beef yield, in a 300 kg carcass
Intra-Muscular Fat % (IMF%)	Estimates of genetic differences between animals in percentage intra-muscular fat (marbling) at the $12/13^{th}$ rib site, in a 300kg carcass
Accuracy %	Provides an indication of the reliability of an EBV. As more performance information becomes available on an animal (or it's progeny or relatives) then the accuracy of its EBVs for particular traits will increase.

Source: The Angus Society of Australia, 1999

"Accuracy" ratings are quoted in percentage terms from 0-99 for Group Breedplan EBVs. In sale catalogues, for example, the recommended layout shows the accuracy as a percentage figure in the box below the EBV.

Table 5: Group Breedplan EBVs

	Birth Weight	200-Day Milk	200-day Growth	400-day Weight	600-Day Weight
EBV Accuracies	+3.1 56%	+9 46%	+13 52%	+31 55%	+39 55%

Source: Agricultural Business Research Institute, University of England, Armidale NSW

If the only information available is the bull's own measured performance for 400-day weight (a trait with a heritability of 30%), the accuracy of his EBV for that trait will be 55%. If 10 progeny records are added to the analysis the accuracy of his EBV will increase to 76%. The individual's performance plus 45 progeny records give an accuracy of 90%.

The following guides are given for interpreting accuracies:

Table 6: Accuracy Interpretation

Accuracy Range	**Interpretation**
Less than 60%	EBVs are preliminary and could change substantially as more performance information becomes available.
61-74%	Low accuracy, but EBVs provide a useful screening for "best bet" animals
75-89%	Medium accuracy, which is based on some progeny records
90-95%	Medium-high accuracy. It is unlikely that EBVs will change much with addition of more progeny data. Use with confidence
More than 95%	High Accuracy estimate of the animal's true breeding value

Source: Agricultural business Research Institute, University of New England, Armidale NSW

3.5 Breedplan – Separating Genetics from Environment

This separation of genetics from environment is a very important feature of Breedplan. When looking at an animal 70% of what is visible is the contribution of the environment (e.g. feed quality, disease, management etc.) to the animal's size – only 30% is due to genetics. However, it is only the genetic component that is transmitted from one generation to the next. It is the genetics that makes an animal valuable for breeding. Breedplan allows us to "see" these genetics separately from the environmental influence.

In an example given by AGBU, assume that the calves from a particular season are split in two ways. Group 1 is run on good feed and Group 2 on poor feed. Calf A in Group 1 has a 400-day weight of 430kg and Calf B in Group 2 has a 400-day weight 390kg (see Table below.

Is Calf A genetically better than Calf B because it is heavier at the same age? Not necessarily. The average weight of Group 1 is 420kg, so Calf A is just 10kg above average. Calf B is 30kg above the average of group 2. Calf B is correctly assessed as being better in its own group. If the two groups are genetically similar Calf B will have a better EBV than Calf A. The higher the absolute weight of calf A is due to the better environment.

Table 7: Analysis of Impact of Genetic Component

Group	1	2
Feed	Good	Poor
Calf ID	A	B
Calf Wt.(kg)	430	390
Average Wt. of Group (kg)	420	
Difference from Average	+10	+30
Heritability of Trait	.3	.3
Difference from Group due to Genetics	+3	+9

Source: Agricultural Business Research Institute, University of New England, Armidale

Because environment is separated out from genetics in the Breedplan evaluation, and the data is analysed over a number of years, it is possible to calculate the genetic trend for each trait. This trend can be calculated for an individual herd or the breed as a whole. Breeders are able to see the progress being made in the traits included in their selection programme. Buyers of genetics can zero in on shopping genetics from those herds whose genetic trend are above the average.

3.6 Comparison Across Herds – Two Case Studies

Breedplan is able to compare cattle across herds provided there are genetic links between the herds. These links are provided by the use of AI sires and the sale of cattle from one herd to another. These links are reinforced by the detailed pedigrees available in Breedplan and breed society databases.

I looked at its development and use in two contrasting breed types, Angus and Brahman, based on the experience of their respective societies.

3.6.1 Angus Breed

I visited Angus Society Headquarters in Armidale to look at their experiences with Group Breedplan. The Australian Angus Society was the first society to become involved in 1984 because they wanted to use more scientific and co-ordinated methods to progress the development of the Angus in a number of areas – performance recording, genetic improvement and identification of traits. Today 85% (50,000) of registered Angus cows are in Breedplan.

The key areas in which Breedplan and EBVs were used by the Angus society are in maternal and fertility traits to improve ease of calving, days to calving (i.e. a live calf every 12 months), growth traits which indicate 200-day and 400-day a good indication of dam performance. The other main areas that society has focused on are the carcass traits such as eye muscle area, rib, rump and intramuscular fat EBVs and retail beef yield. The long-term goal of the society is to keep the breed at the cutting edge as the terminal sire for both the domestic and export beef markets. As the Angus Group Beefplan becomes more widespread new EBVs are being provided for such traits as mature cow weight and marbling, the latter being extremely important in the Japanese and Korean markets.

One of the latest development with this scheme is the Trans-Tasman Angus Group Breedplan which aims to link the Australian and New Zealand societies under the same recording scheme. This type of link is also being developed with the United States because so much American Angus genetics is being used in the Australian herd. This will help create a fair and equitable recording system for the entire breed, which will have a huge effect on its development worldwide.

3.6.2 Brahman

I visited the Australian Brahman Breeders' Association in Rockhampton, where General Manager John Croaker explained the society's involvement in Group Breedplan. They have been involved since 1986 and again are using it to develop the potential and merit of the breed in the difficult environment. The breed itself operates in a most difficult environment where problems such as drought, tickborne diseases and limited forage conditions prevail. Because of the conditions it is the most prevalent breed across much of Queensland and the Northern Territories.

The primary area where the society is focusing on is meat and carcass quality. The breed is not noted for its quality in these areas and a large proportion of its production ends up in the cheaper end of the market-manufacturing beef, and in the live trade to South East Asia and North Africa. Like the Angus Society they are using carcass and meat quality EBVs to improve standards in this area.

The second area that they have concentrated breed development on is the area of maternal traits, particularly in trying to identify and select breed lines with good Days to Calving EBVs. Regular 12-monthly calving intervals are difficult to achieve in the harsh environmental and climatic conditions that prevail, restraining productivity and profitability. There are significant differences between the Angus and Brahman Group Breedplan models because of the way the biology is operating in the northern Australian environment. This includes higher heritability for 200-day, 400-day and 600-day growth and lower heritability for 200-day milk.

As part of their breed development programme the Society places a huge emphasis on developing and utilising an efficient AI service which is particularly noteworthy because of the adverse geographic and climatic conditions under which they operate, creating time and distance obstacles. Of particular note is the emphasis on training farmers and breeders in DIY AI techniques. On visiting a number of AI and breeding centres it's my belief that they are second to none, for example, Wacol Animal Breeding Centre in

Queensland has trained over 5000 farmers in the techniques and they claim that Queensland leads the world in DIY AI!

3.7 Conclusion

Though the Angus and Brahman are two completely contrasting breed types, what this study shows is that the same methodology can be applied to develop the genetic merit and productivity of the breed. The Breedplan system can be tailored to the environment that you operate in to identify specific traits that need attention for the betterment of that breed.

4. Meat Standards Australia (MSA)

4.1 Overview

Grading and its linkage to quality and consumer preferences has always been controversial in the Irish beef industry. I took the opportunity whilst in Australia to look at a new system called MSA which claims to take a whole new approach to this issue incorporating all the elements in the beef animal's life from conception to consumption. An initiative of the Australian government, based in Brisbane, this section briefly describes the events which led to the development of the MSA grading scheme, followed by a description of the PACCP approach and why it is unique to meat grading.

The advantages and disadvantages of introducing a beef grading scheme have been debated by the Australian Meat Industry for many years. In the past the production, processing and retailing sectors have been divided in their support for meat grading.

More recently the attitude has changed to one of widespread support for the concept. A major reason for this change has been a realisation that without some method of guaranteeing eating quality to the consumer, beef consumption trends will continue to decline.

The Meat Industry Strategic Plan for 1996 identified a total of six strategic imperatives, that were considered essential for the longer term sustainability of the industry. Three of these six strategies encompassed the development of better description and marketing systems which would provide a consistent beef eating experience to the consumer. As a means of achieving these goals the Meat Research Corporation (not Meat and Livestock Australia, MLA) has embarked upon development of a new beef grading scheme for Australia. Initially the scheme will focus on the domestic market with later expansion to the quality export markets.

The new grading scheme called Meat Standards Australia (MSA) is vastly different from previous schemes in that it is attempting to focus on satisfying the consumer's needs in

terms of eating quality. This is achieved by controlling aspects of the production, slaughter and processing stages. This contrasts to most other meat grading schemes, which have simply relied on measuring a number of carcass traits at the time of slaughter.

Research had clearly shown that eating quality is a reflection of all the events that have occurred up until the point when the steak is eaten. This includes the genetics, pre-and-post-weaning treatment, pre-slaughter handling of the animal and post-slaughter treatment and processing of the carcass. Failure of only one link in the whole chain could result in a poor eating experience.

4.2 The PACCP Approach

A term that is often used to describe the new grading system is PACCP, which is the acronym for Palatability Analysis Critical Control Points. This term was taken from the food safety sector where their quality assurance programmes are called Hazard Analysis of Critical Control Points (HACCP). In the food safety industry HACCP means controlling those points that increase the risk of food safety. These points are termed Critical Control Points (CCP's). This is similar to the meat industry, where PACCP means those points in the production system which have the largest effect on palatability are identified and carefully controlled so that it is possible to accurately predict the quality of the final product. Via the literature and an ongoing research programme the CCP's that impact upon eating quality have been identified and combined into a workable grading system. A major advantage of such a system is that it is possible to identify multiple pathways to achieve similar eating quality outcomes. By having the price differential between the grades clearly identified, along with the production/processing pathways to achieve certain grades, producers and processors can cost options and decide if achieving a specified grade via a specified pathway is economically viable.

The figure overleaf shows the concept of the MSA grading scheme and the sectors of the production chain in which CCP have been identified.

4.3 Findings

Interesting preliminary results have been presented by the Animal Genetics and Breeding Unit (AGBU) at the University of New England, based on the slaughter of cattle generated for the Cooperative Research Centre for Cattle and Beef Quality (CRC) genetics programme. This programme is one of over 60 across all Australian industries and the only agriculture related research programme funded by the federal government. This project has involved the breeding, feeding and slaughter of almost 10,000 pedigree recorded animals. The results from this project will benefit the Australian beef industry for many years to come. The genetics programme has described the genetic variation in several meat quantity and quality traits between breeds and crossbreds and sires within breeds. The project has added significantly to the pool of knowledge in the field of molecular genetics and its role in the improvement of beef production and quality through marker-assisted selection.

The straight-breeding project consisted of 7800 progeny from seven breeds representing 400 sires, including both temperate and tropically adapted breeds. The cattle were purchased at weaning from co-operating breeders and grazed on pasture. When each group reached the required weight they were finished on either pasture or grain to three important market weight endpoints (domestic 400kg, Korean 520kg and Japanese 600kg). All animals were measured for growth from weaning to slaughter. Ultrasound scans for carcass attributes were recorded at least at six monthly intervals between weaning and slaughter, Animals finished in the feedlot had individual feed intake measured for a period of the finishing. At slaughter complete carcass and meat quality measurements were recorded. As well, since July 1997, samples of striploin of every carcass generated in the project have been evaluated by consumer taste panel as part of the Meat Standards Australia (MSA) programme.

The design of the project enabled the amount of additive genetic variation and the heritability (and trait relationships) for each carcass and meat quality trait to be described.

These parameters could also be estimated for each of the different finishing systems (pasture and grain) and at the three different market weights. As well, the genetic relationship between the different treatments could be estimated to determine if important genotype by production environment interactions were occurring.

One of the major outcomes of the genetic project has been the delivery to the Australian beef industry of the knowledge and techniques to breed cattle whose offspring will meet market specifications and be profitable for all parts of the production chain. Some key genetic results, to date, from the straight-breeding progeny test project are:

- Carcass weight, intramuscular fat % (chemical measure of marbling) and actual retail beef yield % area all moderate to highly heritable in both temperate and tropically adapted breeds

- Objectively measured tenderness is moderately heritable in tropically adapted breeds but low in temperate breeds

- Feed intake and residual feed intake are moderately heritable

- A moderate genetic antagonism exists between retail beef yield % and intramuscular fat %.

- Very high (positive) genetic correlations exist between traits measured on carcasses finished on grain versus pasture

- Greater genetic expression (additive variances) were observed for many of the traits from the heavier market weight animals compared to the lighter market weight

- High genetic correlations exists between ultrasound carcass measurer in breeding bulls and heifers with the same trait measured in the CRC slaughter progeny.

- CRC data and results have provided the basis for new marbling and beef yield % EBVs in Breedplan

4.4 Summary:

Throughout my study tour in Australia it was hard not to be impressed with the level of organisation, the scale of investment in time and money and the great strides that are being made in beef breeding technology and practice. This is all the more impressive when one takes into consideration the difficulties in terms of distance, climate and terrain. There has been a major re-focussing in the industry towards improved breeding strategies which have a relevance in the marketplace. It's fascinating to see that 85% of registered Angus cows are part of the Breedplan programme and that AI is used in 30% of cases. The benefits of this level of planning are clearly seen in the improved genetic merit of the breed and in the fact that they have surpassed the Hereford as the terminal sire of choice in the temperate areas.

Although we may view Australia as a free market economy in terms of agricultural production, the level of state and federal investment both financially and academically is worthy of note and should serve as a guide to the Irish industry. The beef industry is seen as an important natural resource worthy of this scale of investment.

The attempt to link breeding and production strategies to consumer expectations through developments like MSA and the CRC for the beef industry is a hugely progressive step globally, not just in Australian terms. It indicates the direction to which the Irish industry should aspire.

FRANCE

1. Introduction

As part of my study tour I visited France in May 2000, travelling mainly in the Central Massif region which is one of the main suckle beef production areas and home to some of the finest beef breed cattle in the world. I visited many farms, pedigree breeders and research centres working mainly with the Limousin, Charolais and Aubrac breeds.

France is home to 4.2 million of the EU's 12 million suckler cows and as such is the Community's largest producer of beef and live cattle for export. The difficult terrain in the Central Massif makes it unsuitable for arable thus this area has become home to a large proportion of the national suckler herd. The region is both a major beef producer and live exporter.

Regional breed identity is extremely important in France and as a consequence much development work has taken place within breed. Progress in genetic merit has thus been based on identifying superior traits and eliminating inferior traits almost exclusively in a pure breeding context. For the purposes of this study I chose to concentrate in particular on the Limousin Genetic Improvement Programme because of its excellent worldwide reputation and to a lesser degree on the Aubrac programme because of its attention to the development of maternal traits.

I also wanted to look at the producer group system and the distribution of the French national suckler cow quota to see what impact it was having on the development of the industry and what role it could play in improving breeding strategies.

2. The French Limousin Breed Genetic Improvement Programme

2.1. Evaluation and Qualification of Cows

2.1.1 Evaluation

The evaluation of the genetic value of each cow within the breed is carried out by calculating an index estimated from the performance of its calves. Performances are corrected for all influences which do not depend on the cow's genetic value, including that of the herd. Records taken into account are

- **Birth weight** (a contributory factor to ease of calving)
- **120-day weight** (P120, which indicates suitability for suckling)
- **Muscular development**
- **Skeletal development** (judged at weaning).

As soon as at least three calves out of one cow have been tested, the indexes are entered on the cow's **Individual Cow Record.** The indexes for each parameter are expressed in the same units as the factors considered, the average index for the breed being taken as 0. For example, a Limousin cow with a 120 day weight index of +12kg will produce on average calves weighing 12kg more at 120 days than a Limousin cow kept under the same conditions with a P120 index of 0.

2.1.2 Qualification

Cows tested for the publication of indexes may be **qualified** if their **indexes and reproductive performance** (easy, regular calvings) **are higher than the standards** fixed for the breed qualification system.

All cows eligible for qualification are inspected and scored as adults by Herd Book field officers and qualified unless they have serious faults (stance, etc.)

Cows with the best female characteristics are therefore qualified as "Reproductrice Reconnue" or "Reproductrice Recommandee". About 10% of the foundation cows achieve these qualifications.

2.2 Objective Elements for the First On-Farm Selection of Calves at Weaning

A number of factors are available in recorded herds when first selecting (at weaning) bull and heifer calves to be used to breed herd replacements.

They include:

i) The calf's own performance, given in the "Herd Reproduction Record" and on the scoring form, consisting of corrected weights at birth and 210 days, then expressed as a percentage of the average of its contemporaries in the herd, and points awarded for skeletal development, muscular development, functional capacity and breed characteristics;

ii) the genetic value of its sire and dam:

- in the case of dams, from an inspection of information entered on their individual records, especially their indexes, the best being identified by the qualifications "Reproductrice Reconnue" or "Reproductrice Recommandee"

- in the case of sires, from the qualifications.

The importance of each item of this information depends on the characteristics concerned: in the case of those specifically exhibited by the calf the most important will be its corrected performance, complemented by the sire's index and qualification when it has been evaluated; however, in the case of female characteristics only the indexes and qualification of the calf's sire and dam can be used – its dam and its sire, if it has been agreed as "Elevage" (Breeding Animal)

In order to assist selection at weaning, the qualification "Espoir" is used since it is a summary of all this information.

2.3 Station Testing of Individual Performance and Qualification of Young Service Bulls

Natural service has become the principal means of reproduction in Limousin herds in France – 80% of all cows and heifers females are served by this method. A large number of bulls are used each year – 8,000 to 9,000 – of which about 700 are foundation stock.

It is possible to work out values for specific characteristics in these service bulls. Conformation and growth are sufficiently hereditary for breeding on individual performance to be technically and economically feasible. Selection through individual testing is carried out by comparing the performance of the bull in question with that of his contemporaries. Station testing of a number of bulls under identical conditions makes it possible to compare young bulls born in different farms.

In the system developed in France young bulls are kept at the station from weaning at 7 months to the beginning of service at 13-14 months. After a month to acclimatise, they are tested for 4 months, during which they receive a ration designed to give 1,200 grams daily live weight gain. They are then prepared for service. All recording (weighing, scoring and measuring) is done by officially approved organisations. Relationships are checked by the determination of blood groups.

Breeding indexes are calculated for growth potential, muscle and bone development, functional suitability and breed qualities. These illustrate the bull's various traits thus enabling breeders to choose bulls to suit their requirements. An index, however, is only of value for comparing calves tested at the same time (contemporaries in the same batch); it is an approximate estimation of the qualities that one bull will be capable of transmitting to its progeny compared with another in the same batch. This index therefore only has a relative

value. Its significance in relation to the breed depends on the numbers and the quality of the calves of the same age being tested at the same time and in the same batch.

A combined limousine consists of birth weight, growth potential, muscular and skeletal development in accordance with a stock improvement objective with variations in characteristics, e.g. maximum growth potential with limited birth weight.

Provided they do not have major faults in other respects, e.g. functional suitability etc., a maximum of 50% of the bulls in a batch can be qualified at the Lanaud National Qualification Station by the Herd Book as “Reproducteur Jeune” (based on this combined index).

On conclusion of the tests, all results are published in a catalogue containing the individual records of bulls tested, each consisting of:

- the pedigree details of the bull and qualification obtained by its dam and sire
- the “cow” index of its dam
- the performance (growth rate and conformation) of the bull, farm recorded, before weaning.
- The assessment indexes awarded after station testing
- A commercial qualification given by a committee of breeders on conformation when bulls leave the station; B, Beef; M, Dual purpose; E, Breeding;
- The qualification “Espoir” or “Reproducteur Jeune” given by the Limousin Herd Book field officers.

The chance of successful selection from station testing results is twice that from farm results.

Two stations operate in conjunction with each other.

i) A National Qualification Station for the selection and distribution of young bulls with the best records in herd producing breeding bulls;

ii) Local Assessment Centres responsible for distributing good beef bulls to beef production farms.

2.3.1 The Lanaud National Qualification Station

On a visit to Lanaud I was informed that the principal objective of this station is the selection of the best high performanced year old bulls to provide foundation service bull replacements with the qualification "Reproducteur Jeune". The best bull calves from herds registered in the Herd Book enter the station at weaning for individual performance recording.

The station has facilities for testing a thousand bulls at once thus making full use of the potential of the foundation stock.
There are three principal stages in the selection of young bulls:

- The mating of qualified cows in foundation herds by sires designated annually at breed level.

- The selection at weaning by a committee of breeders of different types of bulls with the best records from foundation herds for the production of breeding animals growth rate, conformation (skeletal development, functional capacity, etc), breed standards, ancestry (priority is given to bulls born from planned matings)

- The selection at twelve months of bulls with the best station test results and qualified as "Reproducteur Jeune". (RJ) by the Herd Book for use in the foundation stock. The best progeny tested RJ bulls are given a star. Since a

large number of bulls can be assessed at this station, selection at any one time is very effective.

The first results show that bulls tested here were much superior at weaning in some respects to the average bulls born from foundation stock, i.e.:

- +25kg at 6 months
- +10% muscular and skeletal development

Bulls with the qualification “Reproducteur Jeune” have shown that their potential is generally considerably greater than other tested but unqualified bulls:

- Average daily live weight gain: +1.11 kg.
- Weight at 400 days + 38kg
- Indexes:
    - Growth rate: +7kg
    - Muscular development: +3 points
    - Skeletal development: 5.5 points
    - Functional capacity: +4.5 points
    - Breed characteristics: +3 points.

This station, which qualifies Limousin bulls for foundation stock also enables:

- Farms producing beef to be provided with service bulls carefully selected at weaning
- Service bulls to be disease free
- The selection of bulls for progeny testing schemes to be very effective

2.3.2. Local Assessment Centres

The National Qualification Station is complemented by the Local Centres which provide service bulls chosen specifically for their beefing qualities (muscle development, etc.) to farmers producing beef, but non-members of the foundation stock.

Stock tested at these Centres are chosen at weaning from non-foundation stock in beef herds and from foundation stock from bulls with certain beefing qualities which have been rejected by the National Qualification Station.

Assessment from the results of performance tests at these Centres provides buyers with information on the potential of stock submitted for the principal beefing qualities.

All bulls found at the Centres to have particular beefing qualities are sold to commercial cattle producers at prices which depend on their test results.

2.4 Farm Progeny Testing of Natural Service Bulls up to Weaning

2.4.1. Principle

In view of the large number of cows and heifers per bull and the current practice of preferred mating in France, the testing of natural service bulls necessitates the development of a mating system to eliminate differences between herds. This system is based on the use of artificial insemination in each herd with bulls establishing a link between the herds and the seasons; this enables each bull in the programme to be compared with all the natural service bulls which have been tested over the last five years. In each herd the system involves:

- The planning of simultaneous services and inseminations in order to breed sufficient progeny of the natural service bulls to be tested and compared with link bulls. In order to reduce any bias associated with preferential mating, a field officer selects three classes of cows that the progeny of any bull are neither favoured nor neglected. In addition, correction is made afterwards by taking into account these cows scoring and measurements. In order to establish the links a group of three bulls qualified on the female characteristics of their daughters is employed; on of these bulls is changed annually.
- Standard management of the progeny – same batch, identical supplementary feeding etc.
- Official recording of the parentage, performance and management of calves to weaning. Only the recording of calves out of planned matings, the parentage of which is confirmed by blood group analyses, is used for calculations.

2.4.2 Testing

Forty new bulls are progeny tested annually, taking into consideration the above constraints and the means of follow-up available. The bulls are selected from the best in the National Qualification Station, from phenotypes in shows- provided the owners agree to participate in this performance competition.

Indexes are calculated for four essential factors: birth weight, 210-day weight, muscular development and skeletal development. These factors are important since there is a strong correlation with subsequent performance, e.g. a genetic correlation of +0.8 between weaning weight and weight when finished.

A combined weaning index includes birth weight, 210-day weight, muscular and skeletal development, used with the objective of improving specific characteristics with limitations on another, e.g. maximum improvement of 210-day weight and skeletal

development, with a limit on birth weight. An index of 100 relates to the average genetic value of all the natural service bulls tested for any year and herd, and not to the average genetic value of the AI bulls used as a link. The results of bull testing are only published if the figures are sufficiently accurate.

2.4.3. Qualification

The combined weaning index is used as a basis for qualification. The qualifications "Reproducteur Reconnu" or "Reproducteur Recommande" can only be used for bulls tested sufficiently accurately and with weaning indexes of over 100. In view of the selection of bulls this qualification is equivalent to a genetic value considerable higher than the average of the 2000 bulls in use at any time as foundation stock.

Due to the high genetic value of bulls qualified. The qualifications "Reproducteur Reconnu" or "Reproducteur Recommande", a significant progress in a number of production factors is ensured by the preferential selection of their progeny as replacement breeding of animals.

2.5 AI Bulls are selected for Both Beefing Qualities and Female Characteristics

There are five principal stages in the selection of bulls for artificial insemination for the production of beef breeding bulls and heifers: selection of candidates, individual testing, then for the best 25%, progeny testing for the beefing qualities and recording the female characteristics of the daughters and, finally, official approval of the best. Selection at each stage is carried out by a committee of experts. In addition bulls for natural service with the best test results are also accepted for the scheme.

2.5.1 Selection of the Best Bull Calves at Weaning

Artificial insemination has been chosen for the best bull calves by people responsible for livestock breeding aware of the importance of its effective use in improving the breed.

Since 1984 the 45 best bulls to go to the National Qualification Station each year have been selected by a committee of breeders. The performance of calves before weaning is taken into account, as is the genetic value of the sires and dams (maternal qualities, etc.). Preference is given to bull calves from planned matings between qualified sires and dams. These calves are without doubt superior to those available from the foundation stock; calves weigh on average 45kg more at 6 months and have a better conformation (2/3EUROP class).

2.5.2 Individual Recording at the Naves Station

The performance of young bulls selected at weaning is individually tested at the Naves Station using a national method. The first two months at the station provides the bulls with the maximum opportunity to acclimatise to the station system of management. In order to permit each bull to exhibit its potential growth rate a high energy ration is then fed ad lib for a month, then rationed to achieve a daily live weight gain of 1300 grams for 14 weeks. The daily food consumption of each bull is measured accurately by means of an automatic feeder-recorder. This enables the food conversion ration to be calculated for each bull. At the end of the recording period the bulls are scored and measured (height at withers, etc.). Their genetic values, obtained by comparison with their contemporaries at the station, are estimated for growth rate, muscular development, skeletal development and food conversion.

An index combining these factors enables the bull to be qualified. From the results of the progeny testing the selection committee retains a quarter of the bulls with the best combining indexes. In this system the bulls retained showed a superiority of +31kg at 450 days and about one third of the EUROP conformation class in comparison with those tested. The progeny tested stock is therefore the prime bulls.

The best of the natural service bulls tested with about ten of these bulls selected from the annual series of 12 bulls progeny tested. Testing is for beefing qualities and female characteristics.

To produce this progeny about 120 Limousin cows in commercial herds producing store cattle are inseminated per bull at random under contract over a limited period. All bull and heifer calves from these matings are bought at weaning irrespective of their quality.

2.5.3 Progeny Testing of Beefing Qualities at the Pepieux Station

Testing is carried out on one season's crop of young bulls. About 30 bulls are purchased and sent to the Pepieux Bull Fattening Station where they are fattened on an intensive system on a ration based on moist maize and slaughtered at 16½ months. In addition to recording growth rates and conformation, the following carcass records are obtained:

- Killing out percentage
- Measurement and scoring of carcass
- Carcass composition (fat, etc.)

Beefing qualities are evaluated by comparing the performance of their progeny with that of the progeny (bred under the same conditions) of the three control bulls selected over a period of 10 years from bulls already evaluated. Evaluation is for ease of calving, growth rate and carcass quality. Only bulls with indexes higher than the control are agreed as "Viande" (Beef production) and used for service.

2.5.4 Progeny Testing of Female Characteristics at the Moussours Station

One of the highlights of the French study was a visit to this station because of its unique concentration on maternal traits.
Since beefing qualities and female characteristics are genetically opposed, selection must be specifically carried out for the latter. Evaluation of female characteristics is carried out at a station since:

- Environment has the greatest influence on reproductive performance (low inheritability)
- A system of management must be introduced to give the progeny full scope for showing differences in female characteristics (using the same bull, calving at 2 years, etc.)
- It is difficult to carry out the necessary recording and observing (milk recording, etc.) on the farm.

In order to have a representative sample of a bull's progeny, all his daughters (25-30) from unplanned matings in herds producing store cattle are purchased at weaning for testing at the Moussours Station for two years, from weaning to 32 months.

For the first winter they are fed to achieve a growth rate of 700 grams per day so that they may be calved at two years. They are put out on grass from mid-April to mid-November in batches of 50; they calve indoors and go out to grass again with their calves; in order to assess the heifers' true milk production calves do not receive any supplementary feeding.

The numerous factors recorded include:

- The daughters' growth rates and conformation (periodic weighting, scoring and measuring)
- Sexual maturity (oestrus detection using cows treated with male hormones)
- Fertility; all daughters are served over a period of three months

- The calving condition of the daughters and calf stillbirth rate
- The daughters suitability for suckling: milk recording by weighing calves before and after suckling: calf growth rates.

Genetic value indexes are calculated for several factors (pelvic opening in dams, height at withers, vigour of calves, etc.) and expressed as a proportion of the series average. Four female characteristic indexes are calculated from these factors and published:

1. Beef production value – a combination of the heifers' 18 month weight, muscle development and 18 months bone development indexes

2. Fertility – fertility rate following service at natural oestrus

3. Suitability for calving – estimated from the frequency of easy calvings (1 and 2 points entered by the cowmen at the station)

4. Suitability for suckling – a combination of milk production and 120 calf weight indexes

As a result of these tests, by combining the female characteristics indexes, the best bulls are agreed as "Elevage" (Breeding) and used for artificial insemination.

2.5.5 Official Agreement of the Best Bulls for AI

All the bulls used in artificial insemination must be agreed by the Ministry of Agriculture according to progeny testing results. At the end of the testing period at the Pepieux Station about 5 or 6 bulls are agreed "Viande".

In the same way at the end of the testing period at the Moussours Station 3 or 4 bulls are agreed "Elevage"

3. **The Aubrac**

The Aubrac breed originates from high in the hills of Southern France and the mountainous areas of Central France, regions where in summertime the daily temperature can be 35 degrees or more, plunging to below freezing at night, regions where terrain and pasture is extreme. Originally selection was on the basis of milk production, with monks in the area in the seventeenth century using the cows milk for cheese making. Over recent years the objective for the breed has changed with meat production taking over from milk productions. The breeds legendary hardiness makes it particularly well adapted to producing meat breed animals in difficult environments, inhospitable climates and dry or mountainous regions.

Today there are 55,000 Aubrac suckler cows in France, a much larger proportion of them being registered (18,000 in all) than for many other breeds. Since 1979 Aubrac breeders have their own association, the "Union Aubrac", which today has 430 members.

The "Union Aubrac" breed society in France assures two visits a year to every association member. Another service is the individual monitoring of 70 young sires, which are presented each year at the Borie du Griffoul station. In hill country it is common for breeders to rely on natural service, for reasons of simplicity and convenience. The pre-tests carried out at the station therefore offer a guarantee of the qualities of males for stock farmers about to buy them. This guarantee covers the bull's origin, its health status and its growth performance compared with other animals of the batch. Furthermore, each animal is classified both on arrival and on leaving the station.

Given the main factor affecting breeders income is the ability of females to produce one calf each year for as many years as possible, the main criteria for selection in the aubrac breed have been reproductive trait. One of the most important traits to be measured in the selection of breeding cattle, both male and female being the pelvic area since for hardy breeds this determines the pelvic opening and therefore the direct calving ease. This is the most important trait that can be passed on to daughters. Other selection

criterion include growth rate and feed efficiency rate, since weight affects revenue more than price per kg. The feed conversion rate from poorer quality dry matter is especially sought.

The breed has high fertility with almost 100% of cows mated weaning a calf. Aubrac brood cows breed on longer than any other breed recorded and it is not uncommon to see 15-17 year old cows in some herds that have produced one calf per year of age. The need for any calving assistance being required is virtually unheard of in the breed, and mature cows have been known to have bred back in calf as soon as two weeks after calving; something quite unknown in any other breed. Known as a maternal breed, the main qualities of the Aubrac are its abilities to reproduce, suckle and wean a calf. When crossed with terminal sires such as Simmental and Charolais, they produce beef calves that are in demand for further feeding particularly in Italy and Spain.

The selection programme aims at maintaining breeding qualities, reproduction capacity and hardiness, as well as developing heifers for producing crossbred animals with excellent meat production potential, their muscularity being provided by the bull through cross breeding.

4. Producer and Purchaser Groups

During my study tour in France I was struck by the proliferation of producer and purchaser groups spanning all areas of agriculture. Though the concept may seem very basic it has had a huge impact on the way French farmers conduct and develop their business. From the group shopping of farm inputs to the organised sale of weanlings for export and beef cattle for slaughter. Breed and regional identity is used very strongly to promote and market local produce including beef. The establishment of co-operative marketing groups, is based on local branding and utilises the public's willingness to purchase locally produced beef which is perceived to be of superior quality.

The Central Massif region is a major exporter of weanlings to both Italy and Spain and many co-operative groups have established a network of collection centres where animals are assembled and cards for export are issued. They also advise farmers on proper weaning management and vaccinations to eliminate any problems. Limousin and Aubrac breeders are to the fore in development of these groups and in proper marketing of their progeny. When in Italy feedlot owners I met with spoke highly of the system French farmers employ to supply live weanlings, especially in terms of the quality and uniformity of these animals and their high health status. It was also interesting to note that there was a high level of local Department and government support, both financially and administratively, because these groups play a key role in adding value and enhance the social and economic well being of the regions.

5. Suckler Cow Premium Distribution

France applies the "administrative management" option to all transfers outside of whole holding transfers. This is managed by local authorities at the level of each Department (geographical entity – 90 Departments in France). Allocation of premium rights becoming available within a Department is made within the same area. A committee composed of professional organisations and the local authorities propose priority systems to allocate available premium rights, either on a temporary (1 year) or a permanent basis. Temporary allocations are made free of charge. Permanent allocations call for payment of a "compensation" amount equal to 5.4% of the annual premium payable by the receiving producer to the producer surrendering the premium rights. Priority criteria are decided differently in different Departments. The main priorities concern the following:

- Young Farmers
- Producers with development plans
- Specialist breeders, depending on other enterprises on the holding

Also of note was that similar types of arrangements apply to land leasing and retirement schemes, with the aim being to direct support towards active producers as a means of maintaining the viability of agriculture and rural communities.

6. Summary

One could not fail to be impressed by the superb organisation of French farming and the French beef industry in particular. The time, resources and facilities invested by the various breed societies in the development of the genetic merit of their beef herd is second to none, in particular the Limousin Genetic Improvement Programme. It is not difficult to see why France has produced some of the finest beef cattle breeds in the world. Learning the skills and adopting some of the strategies can only be of benefit to the Irish beef industry. Also noteworthy is the level of involvement of producers, outside the farm gate, in developing their industry and improving the economic wellbeing of farming communities.

UNITED STATES OF AMERICA

1. Introduction

I visited the United States in July 2000 again to look at beef industry in general and in particular, research and development in the beef breeding area.

2. Market Overview

The United States has 33 million beef cows running on almost 900,000 farms and ranches with a high proportion located in the states I visited – Colorado, Montana, Wyoming and Kansas, traditional cow/calf country.

The US produces approximately 25% of the worlds beef supply with 90% of this being consumed in the domestic market. Through the 1990s the industry has been pursuing international beef export markets particularly Mexico, Canada, Japan and Korea, which accounts for almost 10% of total production.

Speaking to many people in the beef industry in the States there was much concern over:

- Lack of breeding strategy
- Traceability and animal identification
- The need to move from commodity based to consumer oriented production

The two areas I wanted to concentrate on in this part of the study tour were firstly the **future of breeding technology** as seen in the US – cloning, DNA markers, genome technology and sexed semen. The second area is **composite breeding.**

3. Future of Breeding Technology

Along with visiting farms, feedlots, research centres and farm organisations across these four states, I had the good fortune to be in a position to attend the annual Beef Improvement Federation Conference in Wichita, Kansas which ran from 12th to 16th July. At the conference many papers were presented covering these topics and I now propose to give a brief synopsis of the more pertinent topics. The Beef Improvement Federation is made up to organisations representing farmers, breeders, processing, research & development, government and among other activities hosts a conference each year to look at development within the industry. In papers presented by B L Golden DJ Garrick S Newman RM Enns entitled "A Framework for the Next Generation of EPDs" they discussed the development of economically relevant traits.

3.1 Economically Relevant Traits

They noted that may if not most traits, which are measured on animals, do not directly affect profit. For example, birth weight is measured not because a commercial producer gets more or less money due to the weight of a calf at birth. Rather birth weight is used to help predict the genetic merit for other traits such as growth rate or the probability of a difficult birth. It is very difficult to assess the economic value of birth weight because larger birth weights are favourable associated with growth rates and unfavourable associated with calving difficulty. When growth rate and calving difficulty are already being considered, birth weight has no economic value.

Another example they discuss is scrotal circumference. Testicular size in normal post-pubertal bulls is not a trait with any economic value to the commercial producer. Scrotal circumference in a sire is favourable correlated to the age at which the sires daughters will reach puberty and is, therefore, an indicator of age at puberty. However, age at puberty is not a trait that is associated with revenue or costs. Age at puberty indicates the ability of daughters to conceive and have calves as two-year-old heifers. When EPDs for heifer pregnancy rate are considered, knowledge of EPDs for testicular size or age at

puberty will reduce the rate of genetic progress for heifer fertility, a trait that directly influences profit.

Traits such as birth weight or scrotal circumference, that are used to indicate the merit an animal has for another trait, are called indicator traits. The traits that we are trying to improve are called economically relevant traits (ERT). Economically relevant traits are the traits that directly affect profitability by being associated with a specific cost of production or an income stream. Indicator traits add information to the prediction of economically relevant traits.

Consider a list of traits thought to influence profit. The development of a formal selection objective requires that the economic value of each trait in the list be determined. The economic values reflect the change in profit for a unit change in the trait, when all other traits in the list are held constant. An indicator trait will have no economic value when the economically relevant traits with which it is associated are included in the list. In contrast, an economically relevant trait's economic contribution should be considered regardless of the presence or absence of any other traits in the objective.

Virtually every economically relevant trait in beef cattle production has multiple indicator traits. The table below contains a list of economically relevant traits and shows typical indicator traits for these economically relevant traits. Undoubtedly there are production and marketing circumstances where other traits are economically relevant.

Table 8: Proposed Economically Relevant Traits and Their Indicators

ECONOMICALLY RELEVANT TRAIT EPD	INDICATORS
Sale Weight Weaning Direct Weaning Maternal (Milk) 600d Weight Carcass Weight Direct Salvage Cow Weight	205d Weight 365d Weight Carcass Weight Birth Weight Fat Thickness Cull Cow Weight
Probability of Calving Ease	Calving Ease Score Birth Weight Gestation Length
Cow Maintenance Feed Requirement	Mature Cow Weight Cow Condition Score Milk Production Gut Weight
Stayability (or LPL)	Calving Records Days to Calving Calving Interval Milk Production
Heifer Pregnancy Rate	Pregnancy Observations Scrotal Circumference
Tenderness	Amount of Intramuscular Fat Shear Force
Days to a Target Finish Fat Thickness Days to a target Weight Finish Endpoint Days to a Target Probability of Grading Finish Endpoint	Backfat and Age at Slaughter Weight and Age at Slaughter Grade and Age at Slaughter
Docility	Docility Scores

Source: Golden B,L Garrick DJ, Newman S, Enns RM' A Framework for the Next Generation of EPDs' Proceedings, Beef Improvement Federation 32nd Annual Research Symposium

3.2 DNA Markers

Daniel Pomp in his paper on the above showed that breathtaking advances are occurring in the knowledge and understanding of the structure, sequence and function of DNA. The entire genetic blueprint, or DNA code, has now been deciphered for humans and a variety of other organisms. This modern-day "Genomic Revolution" may be one of the most important periods in the history of humankind, promising diagnostics and therapeutics for numerous diseases and maladies.

In animal agriculture and particularly in beef cattle improvement, the payoffs of the "Genomic Revolution" have seemingly been few and far between. DNA information on cattle is routinely used for determining parentage, and a handful of DNA diagnostic tests area available for a small number of relatively simple traits. However, the true potential of harnessing genomic technologies in beef cattle awaits application of DNA testing for production traits such as carcass quality, growth, reproduction and overall health status. These diagnostic tools will assist genetic improvement by increasing the accuracy of the selection process, while simultaneously lowering the time required in order to reach effective selection decisions. In addition, they can be used to optimise management practices at several levels of the production chain. In the long term, it is inevitable that the cattle genome will eventually be engineered to design new and improved genetically modified animals and products.

3.2.1 DNA Markers: Identification of Breed and of Parentage

The first application of DNA information in beef cattle genetic improvement has been in providing highly accurate forms of identity testing. The conference was informed that by Evaluating panels of highly polymorphic genetic markers, an extremely unique genetic "fingerprint" of a breed and of an individual animal can be obtained. Several uses of this relatively simple technology are apparent. Primary among these is the determination of breed and of parentage. Determination of breed composition can be used to help sort and

identify genetic potential of cattle. In addition to the obvious utility of determining parentage for registration, sale, embryo transfer and associated purposes, DNA-based sire verification enables use of multi-sire breeding schemes. This latter application may contribute to genetic improvements by enabling retrospective selection; for example, high or low quality carcasses may be traced from the kill-floor back to the sire of origin, allowing selection/culling of sires with high/low genetic potential for carcass traits.

The ability to trace the identity of a sample throughout a complex production chain-of-custody is another application of DNA-based identity testing. While not necessarily directly related to genetic improvement, "traceability" of DNA from meat to carcass to individual animal may become an integral component of quality control and food safety programmes in the beef industry. Tracing DNA may also be used as a tool for verification of identity in shows, contests and competitions.

Genetic tests for simple traits are relatively easy to develop. Indeed, DNA-based selection can already be practised for many such traits in beef cattle. Embryos may no be sexed based on a simple DNA test. Certain coat colour variations can be predicted. Various diseases may be diagnosed at the DNA level. The gene causing the double-muscling phenotype has been identified (myostatin).
The potential power of DNA-Assisted Selection is enormous. Besides the obvious benefit of increasing the accuracy of selection and decreasing the time required to reach selection decisions, there are additional less obvious payoffs. For example, it is currently difficult to genetically increase intramuscular fat without an accompanying increase in overall carcass fat. However, it is increasingly clear that there are individual genes that can influence one trait without changing the other. By focusing selection decisions on targeted DNA information, these negative genetic correlations can potentially be broken apart to achieve more precise improvements.

In the future it is likely that significant advances in the tools of genomics will be required to facilitate the use of DNA testing as a widespread and integral tool for beef cattle breeders. However, such advances can be expected. At some point in the future a

scenario may eventually arise in which a breeder can take a hair root from a newborn calf, swish it around in a simple buffer, spread the solution on a glass slide called a "DNA-Selection Chip", insert the chip into a special port on a laptop computer, input data regarding the breeder's particular selection needs (e.g. emphasise marbling and birth weight more than weaning weight and reproduction) and management practices, and within minutes obtain a highly accurate EPD.

3.2.2 DNA Markers – DNA-Assisted Management

It is likely that the first genetic tests for complex traits will focus on carcass quality phenotypes such as marbling and tenderness. While such tests will certainly be useful in breeding programmes, they may be even more beneficial for enhancing the efficiency of management and production systems. For example, carcass quality genetic testing could be used as an efficient sorting tool in feedlots. Cattle with different genetic potential for marbling and tenderness can be quickly identified and directed to appropriate management regimes to maximise value.

Perhaps the biggest obstacle to commercialisation of genetically modified cattle will be public acceptance. Given the current battle regarding GMO crops, the placement of genetically modified hamburgers in school lunch programmes is not an appetising notion. However, given that genetic engineering of beef products will likely not be a reality for quite some time, the battle over public acceptance of GMO's will almost certainly be fought and decided on battlegrounds other than feedlots and met counters. The results of this battle will largely shape the future use of GMOs in beef cattle production.

3.3 Sexing Semen

In a paper produced by Duane L Garner of X, Y Inc., worldwide license holders of the sexing semen procedure, useful insight is given to semen sexing, whereby the sex of calves can be pre-determined with 85%-95% accuracy. This is accomplished by sorting live bull sperm using a flow cyclometer/cell sorter (SX MoFlo R). This sexing

procedure, which was first developed for living sperm by Dr Larry A Johnson at the USDA Beltsville Agricultural Research Centre, is a patented process. X,Y, Inc holds the exclusive worldwide license to its technology for all non-human mammals and the company has invested heavily to the point that application of this technology to cattle and horses has become a commercial reality. It is a global effort with collaborators within the United States and also United Kingdom, Switzerland, Australia, Germany, Holland, Argentina and Japan.

3.3.1 Process of Sexing Sperm

Bull Semen can be sexed because X-sperm, which produce heifers, contains 3.8% more DNA than Y-sperm, which produce bull calves. Freshly ejaculated sperm are stained with a DNA-binding dye for one hour. This dye binds the sperm proportional to the amount of DNA in the sperm. The stained sperm heads fluoresce bright blue when exposed to a laser beam of short wavelength light. The X-sperm, because they contain more DNA than the Y-sperm, emit more fluorescence than Y-sperm.

3.3.2 Pregnancy and Calving Rates

Hundreds of live births from sexed sperm have been produced with no gross abnormalities observed (Seidel et al., 1999). Rigorous epidemiological studies, however, need to be done to confirm this conclusion. Nearly a thousand heifers have been followed to term and many more are currently gestating. In the heifers that were Followed to term no increase in embryonic deaths were observed between 1 and 2 months of gestation, with very few abortions occurring between 2 months gestation and calving. Some bull differences in pregnancy rates have been noticed but confirmation of this will have to await larger numbers of inseminations per bull.

3.3.3 Applications of Sperm-Sexing Technology

Given the possibility of predetermining the sex of offspring, it is possible to utilise a variety of managerial approaches to enhance production efficiency of cattle operations. One approach is to increase the percentage of heifer calves thereby expanding the herd or to produce replacements for sale. This allows rapid expansion of a herd without risk of introducing diseases that sometimes occur with purchased animals. With the system one could also increase the selection intensity by choosing genetically superior dams for replacements.

Another advantage to the producer is that breeding heifers with X-sperm to produce females would decrease the incidence of dystocia in that most calving problems associated with first-calf heifers are due to the higher birth weights of bull calves. This could be enhanced by the selection of bulls that sire a low percentage of calves with difficult births thereby minimising calving problems encountered with first-calf heifers.

The conference was informed that semen sexing can be used to develop on all-heifer system whereby heifers can be used to produce their own replacements. This single-calf system, when combined with early weaning, allows the dams to be put in the feedlot for fattening and ultimately marketed as beef. This all-heifer management system eliminates the need to maintain a herd of brood cows. Recently, 3 heifers that were produced from sexed sperm calved as a result of being themselves inseminated with sexed sperm. This second generation of calves from sexed, cryopreserved sperm demonstrates the feasibility of this all-heifer production system. Semen sexing can be applied to terminal-cross breeding programmes where the economic value of bull or steer calves can be significantly greater than that of heifers. Other approaches are possible through various combinations of selecting dams for production of superior replacement value of heifers or future breeding sires. The ultimate application of this approach to producing market animals is to have an all-male terminal cross programme. This would, however, require that replacement heifers be purchased. This is essentially the opposite of the all-heifer single calf approach. One application of sperm sexing technology at Colorado State

University's John E Rouse Beef Improvement Centre, in Saratoga, Wyoming, was to produce superior bull calves from 80 selected Angus cows. This will increase the quality of bulls in their annual sale.

3.4 Cloning

Cloning is defined as reproduction using embryonic or foetal cells to give an exact replica of the donor.

In a paper presented to the conference by S L Stice and J Gibbons of University of Georgia, the latest progress in this area was discussed. While much progress has been made in this area, such as Dolly the sheep, the procedures used in cloning are still inefficient, thus limiting commercial application of this technology.

In cloned cattle and sheep the limited viability of embryos and/or offspring with up to 60% loses common as a result of problems during nuclear reprogramming of the donor nucleus. Other major difficulties include placental problems in recipient females. In the 1980s cattle genetics companies envisioned using cloning techniques to multiply genetically superior cattle. Today the biomedical field appears to be the first major commercial opportunity for this technology.

However, these scientists believe there are advantages in developing this technology for cattle breeding. The process of genetic improvement can be greatly speeded up in animal agriculture. Cloning still has the potential for broad-based economic benefits and this will fill the needs of animal production industries that desire reliable sources of high quality breeding stock. Development of cloning and transgenics for use in food producing animals will provide the opportunity to develop animals with traits that improve both the efficiency of production and the quality of products for consumers.

4.Composite Breeding

In July 1999 I attended the MLC/Signet Field Day in East Yorkshire, United Kingdom. This conference included presentations from Richard Fuller of The Beef Improvement Group, Henry Fell, developer of Meatlink sheep and Geoff Simm of the Animal Biology Unit at SAC, Edinburgh.

The purpose of the conference was to confront the problems and propose some of the solutions to both breed improvement and marketing of quality beef and lamb. The two items of most interest to my study were the GLB Charolais programme and the Beef Improvement Group (BIG) Suckler cow replacement strategies.

The objectives of the GLB Charolais programme were to:

- Reduce the unit cost of beef production
- Identification of breeding stock with superior genetic merit
- Improving suckler cow efficiency
- Produce carcasses of high merit to attract premium values
- Satisfy consumer requirements for animal welfare, traceability and eating quality

The breeding strategies that they have adopted include:

- Select Charolais sire lines with high beef values
- Develop a breeding programme to produce efficient hardy composite dam lines with:
    - retained hybrid vigour,
    - improved longevity
    - efficient maternal traits
    - low maintenance requirement

The GLB Charolais was established in 1990 and is developed from three herds combining 250 pedigree cows whose breeding programmes use BLUP with the aim of supplying high beef value bulls and marketing semen to BIG members and leading suckler calf producers.

What was of most interest was that the BIG Group Ltd owned the Nucleus Stabiliser genetics and marketing rights for the EU for the Leachman Composite damlines. This led me back to the United States to look at composite breeding which had been developed by this family owned company based on large scale detailed research at the USDA Clay Centre, Nebraska. The Leachman Cattle company is based at Billings, Montana and is a leading player in the international breeding and marketing of beef genetics with major programmes running in Brazil, Australia and New Zealand. On their home ranch they run 2000 cows and work with a further 15,000 breeding stock on 50 outgrower units across the US.

Through composite breeding they claim to have developed the ideal suckler cow for crossing with quality terminal sires which is now known as the **MARC II COMPOSITE LEACHMAN STABILISER COW.** The Chart overleaf demonstrates how this breed has been arrived at.

They claim that the development of this breed has vastly improved important maternal traits necessary in a good suckler beef cow. Improvements include:

- Milking ability
- Calving ease
- Calving intervals
- Optimum mature size
- Early puberty – two year old first calving

They claim that this cross retains 75% of the hybrid vigour of the first cross and has shown consistent improved conformation, enhanced maternal ability and high levels of efficiency in the production of quality beef cattle.

5. SUMMARY

While travelling in the United States and meeting a cross section of the beef industry there, it was interesting to note the similarity between the Irish and US situation. There was a general feeling that US beef breeding and production was at a crossroads with the lack of a breeding strategy, a lack of traceability and animal identification and that there was a need to move from commodity to consumer based production. The lack of a breeding strategy was very evident in many of the ranches and feedlots that I visited during the course of my stay and contrasted with France, Italy and Australia. However, this has now been realised and major programmes are now underway to develop new strategies.

The United States is at the cutting edge in terms of research and development in the whole breeding area and the advent of new technologies such as sexing semen, cloning and DNA markers are going to have a major impact on the beef industry and pedigree breeding in the next ten to twenty years, accelerating the growth in genetic merit of beef production at a rate previously unknown.

While the notion of composite breeding has developed in the United States it may not have a major impact on the Irish suckler herd, the lessons learned in developing maternal traits, improved beefing ability and consistency of end product are too important to be ignored.

ITALY

1. Introduction

I visited Italy in Oct 2000 as part of an IFA study tour to look at the market for beef and live cattle particularly from an Irish perspective. Italy is a major importer of both and is perceived in Ireland as a high quality, high price market with a lot of potential for both, based on quality product from the national suckler herd. While this project is not about the marketing of Irish beef the link between better breeding strategies and suitable markets is too important to ignore. There is no point in producing better quality beef if viable markets are not there. I would refer you to two Nuffield Scholarship reports. Those by John Finlay and John Butterley for more detailed analysis of market prospects. Bord Bia, the Irish Food Promotion organisation has often targeted moving an extra 1,000 tonnes (300,000 live cattle) annually towards better markets of which Italy is one. Others include Holland, The United Kingdom and France. This would justify an improvement in the quality of stock emanating from the suckler herd and be a reward for the investment.

2 The Italian Beef Market and Live Trade

2.1 Overview

The Italian market is estimated to be approximately sixty five percent self-sufficient in beef. Annual slaughterings are estimated at some 4.6 million head, yielding a total production of 1.2 million tonnes. Young bulls account for some forty percent of total slaughterings with veal calves comprising a further twenty five percent.

Some 225,000 tonnes of total production is derived from imported livestock. France is the major supplier of weanlings/store cattle, with Poland and other Eastern European countries important suppliers of calves for the veal industry.

2.3 Feedlot Beef Production

The feedlot system of beef production is the principal method of beef production in Italy. Feedlot activity is concentrated in the northern part of the country, with four regions, namely Lombardy, Veneto, Piedmont and Emilia - Romagna accounting for nearly two-thirds of beef production.

Cattle are housed on slats and fed with diet feeders, with maize constituting over 50 percent of the feed supplied. They are generally in a semi-enclosed space for the first three weeks after arrival and are then brought inside to the enclosed feedlot. The feed is moved progressively from fodder-based to high protein content during this initial stage. Live weight gain performance varies from 0.8 kg per day to 1.3 kg per day, depending on breed and feeding regime. Feed contents include pressed barley, oats, beet pulp (wet and dry), maize silage, protein concentrate, soya and mineral salts.

The animals remain on the feedlot between five and ten months. Generally cattle are bought in at about 250-300 kgs and are ready for slaughter by the time they reach 550-600kg at an average age of 18 months. The larger feedlots would typically accommodate in the order of 20,000 head. Increasingly smaller feedlot operations are closing down, due to lack of profitability.

2.4.1 Breeds

In a country where live imports dominate, all major Continental beef brands are to be found. As in other European countries, there is a preference for beef produced from local breeds such as the Piedmontese, which is able to command a premium over the mainstream breeds. In a market so large and diverse, there are also regional preferences for different Continental breeds, which can result in a premium being paid.

2.4.2 Cattle Type

Young bulls constitute almost 60% of total adult cattle slaughterings. Steer production is minimal. The remainder of adult slaughterings are almost evenly divided between heifers and cows. Cow beef is predominantly either exported or used for further processing as

domestic consumption of cow beef is almost non-existent except in regions like Rome and Bari.

The market is dominated by cattle of very good conformation and, in most cases, very low levels of fat cover. Young bulls are typically slaughtered at 18-20 months of age, with carcass weights in the range of 380-440 kg, while heifers are slaughtered light and younger. Domestic heifers are generally in the range of 260-320 kg carcasses with a fat score of 2-3. Heifer beef imported from Ireland can weigh up to 340-350 kg and because of its better eating quality fat score can extend to 4L. The popularity of heifer beef is on the basis of its superior eating quality.

2.4.3 Meat Colour

In general, Italian meat colour is lighter due to the younger age of slaughter and intensive meal feeding. Because of this predominance of paler beef, consumer tastes have been fashioned accordingly, bringing about a general preference for lighter colour.

2.4.4 Fat

In a market dominated by young bull beef, carcass fat levels are much lower than those found in Ireland. The trend towards better eating quality, however, is having the effect of more tolerance of fat cover as a result. In areas where there is a significant demand for heifer beef like Emilia-Romagna, there is also a tolerance for fat score 4L on heavier heifers. Consumer preference is predominantly for white coloured fat, which is a natural result of the Italian feedlot system.

2.4.5 Meat Yield

Yields on saleable meat attained are high. Trials suggest that Italian young bull pistola hindquarters will yield at least 5% more saleable meat than well-selected young bull pistola hindquarters from Ireland.

The raw material for the Italian beef industry is from pure breeding lines that yield extremely well conformed carcasses with low fat. These are the carcasses required to achieve very high saleable meat yields.

2.5 Trends in Italian Meat Retailing

The chosen majority supply source of most Italian retailers is Italy, although, given the national beef deficit, all must supplement to some degree with imported product. In the case of French or German owned chains, the bias is towards French or German beef. Irish beef has the highest profile of all imported beef. French beef and to a lesser extent German beef, if identified at point of sale, is generally on the back of heavy promotional support by Sepia/CMA.

In-store butchery is still predominant in the Italian multiple retail sector, despite cost pressures and an increasing shortage of skilled butchery staff. Central packing facilities are almost non-existent although the retail trade is monitoring closely developments on the UK market. Retail displays are of a reasonable quality by continental European standards. Self-service cabinets are increasingly prevalent, although as in other markets, there is evidence the traditional butcher counter will never be entirely eliminated in Italian retail outlets, particularly for the sale of premium lines to the more discerning/concerned type of consumer.

Some retailers contract through processors for the supply of agreed specification young bulls. Targets are set all levels for performance of the feedlot, dressing percentage at the meat plant and yield of saleable meat at processing level.

Quality/farm assurance is not as well developed as in Ireland and Britain. There is as yet no effective national or institutional quality scheme. The retailer has pioneered this whole area in Italy, and quality assurance is an essential requirement for Irish suppliers to this sector.

With regard to beef lines, young bull is the mainstream beef line in most cases, often endorsed by the retailer's own label. Veal is another staple line within the beef family. Domestic breeds of heifer beef are often carried as the high price premium line. Selected Irish beef where it is branded tends to be positioned as a medium-high priced line, occupying a distinct quality segment, Non-branded/economy lines generally complete this range-this is adult beef from a range of domestic or imported sources. Despite the

for fat cover vary. In some regions, customers of Irish beef will require fat up to Grade 4L, while in other regions the requirement is for leaner grading carcasses. Irish exporters have to select product very rigorously for this market, to meet the above requirements. However, customers report that Ireland's capability in this regard has improved steadily in recent years. This is a consequence of the increased supplies of cattle from the suckler herd.

2.6.2 Market Channels Supplied

Approximately fifty percent of Irish supplies go to the multiple retail sector. The balance is supplied largely to wholesalers (servicing independent retailers, butchers and the catering sector), with a small proportion of sales directly to food service operators and processors.

Ireland is the second country of origin, after Italy itself, most commonly identified and promoted to consumers by multiple retailers. Ireland's particular success with the multiple retail sector is linked to the competitiveness of Irish beef and Irish Supply

capacity. Italian multiple retailers in many cases have chosen to differentiate and promote Irish beef to the consumer on the basis of its origin and associated attributes, i.e. the product is grass-fed, natural, tastes good and is subject to rigorous quality control.

In parallel with the development of the retails business, Irish exporters have increasingly targeted the Italian catering sector in recent years. Many of the leading wholesalers supplying this sector in northern Italy are using Irish beef.

2.6.3 Strengths and Weaknesses

Strengths:

- Eating quality – taste and tenderness
- Product extensively produced largely off grass
- Quality assured

- Ability to supply cuts in volume

Weaknesses:

- Colour of meat and fat – different to domestic product

- Distance from market:

    - Shorter shelf life
    - Longer lead-time for orders, restricting ability to supply beef at short notice

- Significantly lower meat yield than domestic product.

2.6.4 Live Trade

Irish live exports to Italy reached over 70,000 head annually in 1999 and 2000 with a good demand for the top quality bulls and heifers from the suckler herd, specifically Belgian Blue and Limousin and Charolais cross. Italian importers that I spoke to expressed satisfaction with the quality of Irish stock coming through because of their ability to perform very well in feedlot conditions. They did express concern about some health problems as a result of Irish weanlings coming straight off cows particularly from September onwards. The same problem had existed in France, but proper weaning management and vaccination eliminated this. Our major competitor for this trade is French live exports which because of their high genetic merit and superior to anywhere else in Europe. It was interesting to see high quality Limousin and Aubrac cattle from the Central Massif region of France which I visited earlier in my study side by side with cattle of Irish origin. The general view was that French Limousins and Aubracs performed best, but were closely followed by Irish Belgian Blue and Simmental cross which in turn were far ahead of cattle from eastern Europe which were mainly of dual purpose Simmental origin.

2.7 Grading and Payment

Italy has a different system of grading and payment for cattle. All cattle are sold liveweight less 3% to allow for gutfill. Payment is based on kill-out percentages on which a guarantee is given at point of sale and if this is not reached the price can be adjusted accordingly. Estimated kill-out percentages for bulls are as follows:

Table 11: Kill-out Percentages

	Kill-Out Percentage
Limousin	63%
Belgian Blue	61-62%
Pure Charolais	59-60%
Salars	57%
Simmental	56-57%

3. Summary

Since my visit to Italy the BSE Crisis of November 2000 has created major problems in the beef and live cattle markets there with an initial 30% drop in consumption and near closure for Irish exports of beef cattle. However, through 2001 and 2002 the market has recovered and all predictions are that it will continue to recover quickly to normal trading patterns.

There is no doubt that Italy should continue to be a major target for Irish exports and that the potential for market development cannot be ignored. Developing markets like Italy is the type of incentive that is required to encourage improved breeding practice in the national suckler herd in Ireland. I believe also that we need to develop coordinated marketing strategies linking producer to processor to retailer to fully achieve our potential in this market, similar to the French industry.

We also have a lot to learn from the Italian system of grading and payment which incentivises and rewards quality production.

CONCLUSIONS

1. High genetic merit beef herds are easily developed even in the most difficult economic and environmental conditions.

2. There is a globalisation process underway in beef breeding based on BLUP, EBVs, EBDs, positive trait identification and selection.

i) cutting edge research in the USA, France and Australia is going to accelerate breeding strategies worldwide in a way not seen heretofore.

ii) There is a switch towards beef breeding strategies for sustainable markets which reflect consumer preference and away from commodity based production. The beef industry is moving to a stable to table concept with all links in the chain contributing to a greater or lesser degree to a successful outcome.

iii) Despite negative aspects of beef breeding and marketing in Ireland I believe we have a strong base to build on, the following being:

- A reasonable national herd on which to build
- Good farmers with excellent practical and technical skills
- Lower costs in terms of grass based production
- Agriculture is still seen as a vital contributor to the Irish economy
- Strategically placed on doorstep of the best market in the world; the EU
- Excellent traceability through the operation of the CMMS

RECOMMENDATIONS:

1. Replacement Strategy:-

- That Teagasc, the state farm advisory organisation, develop strategies that encourage movement to a replacement strategy within the beef herd, eliminating over time the Holstein/Friesian influence present.
- That they encourage the utilisation of AI and synchronisation through training programmes as a way to accelerate genetic improvement in individual herds, and as a gateway to better breeding technologies such as sexed semen
- That they work in partnership with ICBF as part of their strategy to improve their beef breeding programmes.

2. Development of the Irish Cattle Breeding Federation:

- To encourage full co-operation by all breed societies, farm organisations, government agencies, etc, in helping the ICBF in its objective of achieving the greatest possible genetic improvement in the national herd.
- To utilise all information banks in terms of CMMS, animal carcass weights, birth dates, slaughter weights sires, etc., to develop a database from which to enhance breeding strategies.
- To access and utilise European and worldwide genetic evaluation procedures and developments which would have a positive impact for Irish farmers
- To encourage and facilitate the use of AI and synchronisation as part of farmers' breeding strategies through the take-up of training programmes licensed and regulated by ICBF
- To develop cost effective strategies that allow farmers full access to all available breeding technologies, e.g., through better regulation, use of synchronisation programmes that do not rely on prohibited drugs

- To develop beef and maternal traits data that can be used both within and across breeds

3. Structure of National Herd

- That government develops a more efficient distribution of suckler cow quotas that, for example, targets commercial farmers, young farmers and so builds up a nucleus of sustainable herd sizes that can make better use of emerging breeding technologies
- That government use discretionary EU funding, e.g. National Envelope, to encourage the upgrading of the suckler herd by encouraging a higher replacement rate, that increases the genetic merit of the national herd
- That government encourages more cost effective suckler cow quota transfers through limiting the leasing of quota, ring-fencing non-disadvantaged area quotas and giving tax breaks for quota purchase, thus helping to concentrate quota in the hands of active and progressive producers.

4. Breeding for the Market

- That farmers in Teagasc discussion groups be encouraged to form producer and shopping group structures that will help to develop their potential as breeders and producers of market orientated products.
- That government use funding from the National Plan to develop producer/co-operative groups with retailer/consumer links and provide human resources which can develop sustainable markets for quality beef from the suckler herd
- That we take advantage of compulsory labelling of beef, now a fact in the EU, and move towards a national label for quality Irish beef, linked to quality assurance
- That government and industry increase promotional funding for Irish beef particularly on the European market. Current levels of funding are not adequate to develop the potential of quality beef from the national suckler herd
- To encourage a level of autumn calving in the suckler herd to eliminate seasonality and encourage more year round marketing in both the beef and live export sectors

- To develop grading systems that reward quality production and reflect the true value of beef from higher genetic merit herds, for example, mechanical grading or payment on meat yield bases
- That government and industry defend the live export market as an important outlet for progeny of the sucker herd because of its role in encouraging better beef breeding and improving the economic wellbeing of farmers and producers.

It is important that the Irish suckler herd is seen as a national resource underpinning the beef industry for the benefit of producers, processors, consumers and ultimately the economy. As I complete this report we are just emerging from the BSE crisis which has affected confidence and profitability in the industry. It is important that this be seen as a short-term crisis that should not deflect from the overall objective of producing a world class beef industry, one which we are well capable of if all sectors work together. Today we face a new potential threat in the form of the proposed Fischler reforms to the CAP and Agenda 2000. These reforms have the potential to seriously impede the development of a high genetic merit national suckler herd producing quality beef and live cattle. It is important that government, farm organisations, and industry unite to ensure that the best possible outcome is achieved so that the industry's true potential can be realised.

In conclusion during the course of my Nuffield Scholarship Study Tour the most important thing that I learned was how similar farm families and rural communities are throughout the world. Their hospitality, generosity, willingness to learn and share experiences is something that has left a lasting impression. I believe that there is a huge responsibility for farm organisations, policy makers and government to defend farm families and rural communities because of the outstanding contribution they make to the economic and more importantly social wellbeing of society.

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