Report on how beef genetics can help increase the profitability of UK beef farmers

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Introduction

The UK beef sector is a vital part of the UK economy, with sales of beef exceeding £7billion annually. Through its diversity of adapted breeds it also plays a vital role in maintaining the UK genetic resources. The industry is however continually under pressure to remain competitive and long-term sustainability is likely only to be achieved through innovation.

The beef sector is traditional and highly fragmented which makes it difficult for producers in particular to embrace and capture value from innovation. As a result, even where new technology and approaches are known to help increase production efficiency at farm level, the overall level of adoption is often low. Where it has occurred there is sound evidence to show that it can have a dramatic and positive effect on performance and profitability. Genetic improvement in other livestock species has resulted in dramatic improvements in the efficiency of production. There is no reason why this cannot occur within the beef sector.

The UK government held a summit in the summer of 2014 to consider the state of the beef sector. One of the outcomes was the belief that the better use of genetics could bring about opportunities for improving profitability and trade for British beef.

The reconstituted UK Farm Animal Genetic Resources (FAnGR) Expert Advisory Committee was asked to conduct a scoping study and to come up with some clear government/industry recommendations which could bring about improvements throughout the beef supply chain.

Background

The meat sector is an important part of the UK food industry. Beef meat sales exceed £7 billion annually. Beef exports equated to £371m in 2013 (EBLEX figures) with significant potential to rise further if new and emerging market opportunities are taken. These new markets are highly focused on quality beef, which is a function of new middle class consumers increasing from the massive urbanisation programmes in China and Asia more broadly. The British beef industry has a sound foundation for producing quality beef but needs to act now to up its game.

At home in the UK we have relatively high self sufficiency in beef at around 77%, with consumer demand strong and farm gate prices increasing in recent years. Export beyond Europe remains an untapped market both for meat and germ-line products (genetic material, semen and embryos). In respect of meat, our native breeds are optimally placed to respond to the UK export strategy which is to position English beef as a premium grass-fed, matured product for food service with an emphasis on sensory quality, tradition, history and culture; grass and water; naturalness, environment and purity, and importantly healthier nutrition from grass-fed beef.

UK beef currently

Approximately 2M cattle are slaughtered annually in the UK to produce beef reared under a wide range of production systems. We have a diverse range of native breeds and breed crosses that are adapted to different production environments. Some of these cattle either originate from, or are related to, animals in the dairy herd (accounting for around 35% of genetics in the slaughtered population), but the majority are either purebred beef or crosses between beef breeds.

The relationship between production system and environment is vital. The production of beef cattle (along with sheep) is a significant part in the economic sustainability of rural communities and in maintaining rural landscapes. Many beef cattle are born and reared in hill and upland areas (LFA land). The calves are sold directly into the beef market or for further breeding through crossing, or finishing on other upland or lowland units.

Many decades of breeding cattle to best fit the range of UK environmental conditions has resulted in the establishment of a rich diversity of breeds. The diversity offers a wealth of genetic resources and gives potential to make use of a high proportion of the grassland that the UK landscape has to offer. This ability to adapt breed to environment is highly valuable in optimising the efficiency of land use.

Despite a positive outlook for the UK beef industry, years of low profit margins have eroded producer confidence resulting in a slow but steady decline in the total number of cattle being produced, and a reluctance by producers to invest to increase production when prices rise. This leaves a gap in production capacity which is a disadvantage if we are to effectively respond to new markets.

The industry can improve. The industry is traditional and highly fragmented with many producers slow to adopt new knowledge, new approaches and new technology (such as genetic improvement of animals) even though these would increase production efficiency.

Where adoption has happened, there is sound evidence to show that it can have a dramatic and positive effect on performance and profitability as demonstrated by the significant difference between the average and top third of producers. (EBLEX Stocktake report 2014).

Genetic improvement has resulted in dramatic improvement in the efficiency of production in other livestock species, and also offers a powerful tool for beef cattle. If effective recording schemes are established, it offers a tool that can deliver real benefit in all breeds, not just mainstream breeds.

Practical steps for accelerating genetic improvements in beef

Modern breeding approaches use computer-based estimates of an animal's genetic worth (against a number of market important values including production efficiency). This information informs the selection of the next generation of parents.

The genetic estimates are generated by taking account of both pedigree information and ideally data related to commercial performance of the animal and/or its relatives. This approach has had a dramatic impact in the dairy industry by doubling milk yields. Substantial improvements have similarly been achieved in the pig and poultry industries. The challenge is to increase use of genetic indices in the beef industry and see material gains to benefit home and global market positioning.

A genetic estimation service has been on offer to the UK beef industry since the early 1990s (initially through Signet/Meat and Livestock Commission) but due to the fragmented nature of the beef supply chain, commercial data is not reliably linked to genetic estimation data. Today much of the performance data recording is through pedigree breed societies each selecting their own provider (these include: Signet (EBLEX), the Australian Breed Plan services (ABRI) and the British Limousin Cattle Society (for their own breed) with costs borne by the pedigree breeder.

These performance data schemes have focused on improving characteristics that are related to the performance of commercial progeny and /or the attributes which are vital to rearing a commercial calf. Much of the recording has also focussed on measurements that required additional tests (e.g. ultrasound) with the full cost of recording largely (particularly in recent years) being borne by individual breeders. The rate of breed improvement is a function of the number of pedigree herds recording and the degree of genetic links between those herds, which is often difficult to achieve for breeds/breed societies that do not have structured breeding programmes. In addition, given the fragmented nature of the supply chain, it has not always been possible for breeders and producers to realise the true value of the higher genetic merit animals when they were sold on.

As a result of these challenges, the current level of recording uptake is low and the optimisation of genetic improvement not realised in the majority of beef breeds. Currently it is estimated that less than 15% of UK beef are involved in performance recording. This compares with the dairy-farming sector where the comparable figure is nearer to 50%.

Faster genetic improvement is evident where the use of selected High Performance bull(s) is/are sponsored across a number of herds and performance data of the progeny are recorded across a statistically large enough sample to validate the improvement. This approach yields quantifiable improvement that is evidenced in an improved fitness for market. Typically, breeders are offered straws of semen from the bull at no cost on the understanding that they cover AI costs and agree to performance record progeny. Such

schemes could be incentivised further if there were EBLEX sponsorship and the potential to link carcass data to genetic performance data for review and feedback to producers.

Recommendation 1
- Sire reference scheme: Levy organisations, working with breed societies and retailers, to incentivise herds to use selected high performance index sires and to collect and analyse progeny and potentially carcass data of progeny.

Benefits from co-ordinating across the industry (data linkage opportunities)

The UK beef supply chain generally consists of five key players:

1. bull producer (generally pure-bred and including high genetic value bulls),
2. cow/calf/ young stock producer (sometimes pedigree but more generally crossbred animals),
3. a beef finisher (takes beef calves to market readiness),
4. abattoir/processor
5. retailer.

The level of collaboration, feedback and sharing of data along the supply chain has been low. Without market feedback, animals may be less competitive in the market place. If a greater level of collaboration could be fostered across the industry to achieve beef animal genetic improvement informed by market requirements, substantial increases in the efficiency of beef production in the UK could be achieved.

Even more progress could be made in improving the overall efficiency of the industry by linking up data that is collected through initiatives led through government departments or agencies (e.g. BCMS, FSA and APHA).

The Republic of Ireland has an exemplar in the Irish Cattle Breeding Federation (a Government/industry initiative) which harnesses the value of linking various datasets for cattle (beef and dairy), and by coordinating a genetic/Knowledge Transfer (KT) programme for beef producers.

A number of reports by UK industry bodies have also suggested that considerable industry impact could be achieved by establishing a similar initiative in the UK (e.g. HCC- Meat Promotion Wales "A Review of the Beef Sector in Wales"/Beef 2020 in Scotland), but as yet there has been no concerted effort to develop a UK wide strategy to help attain such a goal.

Whilst the establishment of single central data source would likely not be achieved without substantial cost, it is important to note that smaller and less costly steps can achieve much of the benefit. For example, implementing greater data sharing and coordination between existing industry-led and government-led recording schemes.

Recommendation 2
- Establish a joint UK strategy (across government and industry) for converging elements of existing recording systems for cattle to enable readily shared data collection and use.

Possible options to deliver change and on-going projects

CTS/BCMS

For commercial data to be of value in genetic predictions, it must uniquely identify individual animals and identify their parentage. The data being collected as part of the Cattle Tracing System (CTS) of the British Cattle Movement Service (BCMS) offers an excellent starting point by providing unique animal IDs and dam identity. Providing the commercial data is recorded using the same unique ID, use of the BCMS data offers the means to piece together the animal's parentage. Unfortunately, reporting of sire ID is only voluntary on BCMS and as a result the current level of sire recording is low – at around 30%, undermining the value that can be derived from the data.

The potential value to the industry of recording this data has been recognised, and there are now a number of initiatives underway to encourage producers to do so.

Recommendation 3
- Increase sire identification recording: staged implementation to increase sire identification recording through BCMS starting with pure bred cattle. (Consider introducing change in legislation to require eventually the compulsory recording of sire identification)

Use of Abattoir data

When beef cattle are slaughtered in the UK, the majority of carcasses are classified for fat cover (using a 7 point scale) and conformation (shape) using an 8 point scale. Where animals are sold directly to the abattoir, the value of the carcass is determined by the category (sex), age, classification and carcass weight, and the information is passed back to the producer. This offers a valuable source of data that could be collated, combined with BCMS data and included in genetic evaluations for UK beef cattle.

In 2013 a project was initiated (funded by AHDB and HCC) to directly investigate the possibility of routinely using carcass data from abattoirs in genetic predictions for purebred beef and dairy breeds. It is expected that preliminary results (for a small number of main breeds) will be reported in 2015.

Recommendation 4

Support industry efforts to collate abattoir data and include in genetic improvement programmes

Disease data - abattoirs

Carcass condemnation data is also collected in abattoirs (e.g. lungworm, liver fluke and parasitic worms). Although this information is occasionally fed back to producers to aid management decisions in some cases, it is not common, particularly where animals have been bought through live auctions.

If the activity was more coordinated and widespread it could also be used to generate wider industry benefits through reporting of regional maps for incidence of various diseases, which could be used to help in combination with weather predictions to optimise management approaches for disease prevention.

As with carcass classification scores, when combined with BCMS records this would also provide a valuable source of data for genetic predictions of an animal's susceptibility to such diseases. Such information would be particularly valuable on farms where the level of disease challenge is difficult to manage.

Recommendation 5a and 5b

In conjunction with the FSA, industry should develop a more informative and accurate recording of carcass condemnation data on an individual animal basis for feedback to producers and for use in national genetic evaluations, surveillance and epidemiological studies.

Industry should develop a more collaborative and standardised approach that would allow greater benefits to be derived from the carcass condemnation data that is currently collected.

Disease data – bTB and other

Beef breed societies have been very effective in getting their members to participate in health schemes under the Cattle Health Certification Standards (CHeCS) umbrella – the potential to bring all this together is huge.

UK research has clearly established that genetic variation exists between UK dairy cattle in their susceptibility to bovine tuberculosis (bTB). Following agreement by Defra to release data on TB test records for all affected UK herds, it is anticipated that the first genetic predictions for dairy bulls will be published for consultation with the industry in 2015, prior to publication to the wider industry being considered.

Considerable value could also potentially be gained by extending this work to include collation of data for tests on other diseases, such as Johne's, the susceptibility to which is already known to vary with genetics.

Recommendation 5c

Encourage the inclusion of animal health data in the joint UK strategy mentioned at recommendation 2, to add value to existing activity.

Feed Efficiency

Feed accounts for a high proportion of costs in any livestock production system. Small changes in feed use efficiency can have a significant effect on profitability and greenhouse gas emissions per kg of product. Genetic improvement in feed efficiency has played a very important part in increasing production efficiency in the pig and poultry sectors in recent years.

Of obvious importance in beef cattle, the challenges of large scale recording of feed intake in individual cattle has not yet been successfully achieved in the UK.

In 2012, Defra commissioned a scoping study to identify industry supported options for larger-scale recording of feed efficiency in UK beef cattle. This project modelled the potential impact, consulted with different UK industry stakeholders and benchmarked international best practice (Defra report IF0207) and provided the background knowledge needed to make an informed decision on how implementation could be done in the UK.

Since January 2015 a four-year £1.75M project, (with £1.5M of the funding being provided by Defra) has been started that includes more than 20 different industry organisations, and is aimed at establishing (i) industry standards for recording feed intake in the UK, (ii) a network of industry embedded cattle performance-recording facilities, and (iii) more collaborative supply chain approach to deliver improved feed efficiency in UK beef cattle.

This project is being led by AHDB/EBLEX (the English levy body for red meat), supported by SRUC, with the wider consortium already including a range of key partners from different parts of the UK supply chain (including a number of the largest beef breed societies, abattoirs/processors and retailers in the UK, as well as the red meat levy boards for Scotland, Wales and Northern Ireland).

Recommendation 6
- Government should continue to support this industry led initiative to develop a national network of units for recording feed efficiency and thus establish a lasting business model that creates more industry led facilities for measuring feed intake.

New Grading Scheme

The EUROP grid classification system was built when limited technology was available, to provide a "common language" to describe carcass characteristics for trading. It was subsequently used to support intervention. There is a growing belief that a new payment method is needed to reward ever increasingly sophisticated farmers and to reflect changes in the way carcasses are butchered and changes to the value of various carcass parts. Video Image Analysis (VIA) allows valuing of the complete carcass based on predictions of meat yield in various parts of the carcass each of which has its own retail value. ABP has implemented this technology and is now feeding those market signals back down its supply chain. Given this change, the obvious question is "are there other attributes of the carcass that can be measured and rewarded accordingly?" Examples are meat quality, shelf life, shape etc. This requires development of appropriate objective measurement tools to enable a fundamental shift in the mechanisms to value meat and considerable work would be needed to develop grading and reward systems that are relevant, transparent and sustainable.

Recommendation 7

Encourage a reappraisal of grading determinants for new and emerging markets.

New technological opportunities

New technological advances in "genomics" and molecular genetics could allow the UK to achieve real commercial exploitation of our beef genetic resource. Already within the dairy industry breeding companies are using these new approaches to select better performing cattle and then commercialise their products and services. For example, around 50% of all new inseminations are from sires with only genomic evaluations. The beef industry can exploit this pre-existing and validated technology to accelerate its own genetic improvement.

One industry led project (involving ABP, the British Limousin Cattle Society and SRUC) is already underway to generate value from using genomics in the genetic prediction for retail value of the carcass using enhanced imaging (VIA) in the abattoir. This is expected to be rolled out to the Limousin breed during 2015.

In 2014 EBLEX commissioned a review of the value from genetic improvement in the beef and sheep industry and the potential value that could be gained for using genomics, which is due to be completed by June 2015. Members of the FAnGR committee have contributed to this review. This project will report in 3 main areas:

- Financial benefits of breed improvement (an update of 2007 data),
- Strengths and weaknesses of the current structure of breed improvement services in the UK to exploit new technologies,

- How the benefits of genomic technologies can be captured for the UK beef and sheep sectors.

It is expected that this review will inform the development of enhanced genetic improvement programmes and identify blockages to exploitation.

Supermarket/processor schemes

Most retailers do offer premium meat wholly or partly from UK native breeds. Products are promoted on their quality, flavour and tradition (provenance in general). This market segment incentivises farmers to review their breeding.

The table below shows how some of the retailers are addressing this premium end of the market.

Supermarket	Native breeds	Scheme details	Volumes
Tesco	Aberdeen Angus	Certified Angus cattle.	130,000 carcasses per year
Morrison's	Beef Shorthorn	30p/kg deadweight beef shorthorn or beef shorthorn sired crosses.	Up to 21,000 additional cattle sourced per year
	Other native breeds	10p/kg deadweight for native breeds. Cattle must be finished on a 35% starch diet for 100 days, with starch preferably from a cereals source. Partnership programme with Stabiliser Cattle Company	

	Stabiliser		
Co-operative	Hereford	Hereford cross cattle eligible.	Up to 16,000 per year
Waitrose	Aberdeen Angus Hereford Welsh Black Highland	75% forage requirement Forward price premium for suppliers	All meat selected and butchered/packers by Dovecote Park
Marks and Spencer	Aberdeen Angus		

What has yet to evolve is any attempt from the marketplace to build into their quality specification anything about genetics or genetic improvement. At the moment being a native breed appears to be enough. Of the major retailers, Morrison's would appear to be seeing the potential by active selection and the breeding of high performance animals through the entire supply chain. This involves on-going R&D spend, Knowledge transfer (KT) activities and a financial premium for farmers supplying them.

One notable example is the development of Stabiliser cattle; a hybrid breed. These cattle are developed commercially to be produced under a well managed, recorded breeding programme which is designed to minimise costs and to increase the output of consistent high eating quality beef from forage based systems. Stabilisers deliver significant breed improvement for all commercially important traits including Net Feed Efficiency outcomes that save 12% in feed costs and about a 20% reduction in Greenhouse gas emissions by identifying the most feed efficient breeding animals. The Stabiliser Beef Company has a Marketing Partnership with Morrison's to target cattle at a specific market with feedback by the retailer to best select for future improvement. There are other emerging supermarket schemes which, with encouragement, could follow a similar pathway.

Recommendation 8

In encouraging the development of a joint UK strategy (as at recommendation 2) include steps that would allow the UK to be well placed to take advantage of benefits from using genomics.

AHDB should pool resources to focus on genomic improvement in beef cattle.

Recommendation 9

All involved in the beef supply chain should continue to support retailer initiatives (e.g. supermarket schemes) using native breeds/genetics to achieve improved feed efficiency and commercial relevance.

Conclusion

This short paper has highlighted that despite a highly fragmented industry there are signs of a market led future with appropriate use of genetic evaluations at the centre of a sustainable beef supply chain. A number of recently awarded projects are combining to create an environment conducive to genetic improvement in beef and the momentum must be maintained.

In the future one could see increased greater integrations with health data and the better matching of animals to production/feeding systems. Feeding and health management could be tailored to genotype for targeted efficiency.

The UK beef industry is well positioned to seize opportunities to respond to the "market pull" that exists. It could be argued that historically we have relied on a "product push" approach to commercialisation

A focus on quality and provenance is a strength of the UK's native breeds. This is manifest in supermarkets' interest in "branding" a beginning to end supply chain with particular native/traditional beef breeds (e.g. Waitrose and Angus, Morrison's and Beef Shorthorn). Similar drivers exist for the new global markets and the UK can best rise to this challenge by leveraging the genetic resources in our UK breeds. We can select faster and more efficiently for beef animals that meet market needs; we can evidence quality through carcass quality, nutrition, health and traceability and sustainability through better convergence of existing data and we can use modern genomics technology to position beef genetics in the global market as semen, embryos and characterised genetic elements that themselves will have wider commercial applicability in an expanding IP licensing and technology market.

The recommendations given in the text and reproduced below can enable change to happen and in good time. A small group that would work with key interests and stakeholders to make these recommendations a reality would be important in order to galvanise action.

Summary of recommendations

Recommendation 1- Sire reference scheme: Levy organisations, working with breed societies and retailers to incentivise herds to use selected high performance index sires and to collect and analyse progeny and potentially carcass data of progeny.

Recommendation 2 - Establish a joint UK strategy (across government and industry) for converging elements of existing recording systems for cattle to enable readily shared data collection and use.

Recommendation 3 - Increase sire identification recording: staged implementation to increase sire identification recording through BCMS starting with pure bred cattle. (Consider introducing change in legislation to require eventually the compulsory recording of sire identification).

Recommendation 4 - Support industry efforts to collate abattoir data and include in genetic improvement programmes.

Recommendation 5a - In conjunction with the FSA, industry should develop a more informative and accurate recording of carcass condemnation data on an individual animal basis for feedback to producers and for use in national genetic evaluations, surveillance and epidemiological studies.

Recommendation 5b - Industry should develop a more collaborative and standardised approach that would allow greater benefits to be derived from the carcass condemnation data that is currently collected.

Recommendation 5c - Encourage the inclusion of animal health data in the joint UK strategy mentioned at recommendation 2, to add value to existing activity.

Recommendation 6 - Government should continue to support this industry led initiative to develop a national network of units for recording feed efficiency and thus establish a lasting business model that creates more industry led facilities for measuring feed intake.

Recommendation 7 - Encourage a reappraisal of grading determinants for new and emerging markets.

Recommendation 8a - In encouraging the development of a joint UK strategy (as at recommendation 2) include steps that would allow the UK to be well placed to take advantage of benefits from using genomics.

Recommendation 8b - AHDB should pool resources to focus on genomic improvement in beef cattle.

Recommendation 9 - All involved in the beef supply chain should continue to support retailer initiatives (e.g. supermarket schemes) using native breeds/genetics to achieve improved feed efficiency and commercial relevance.