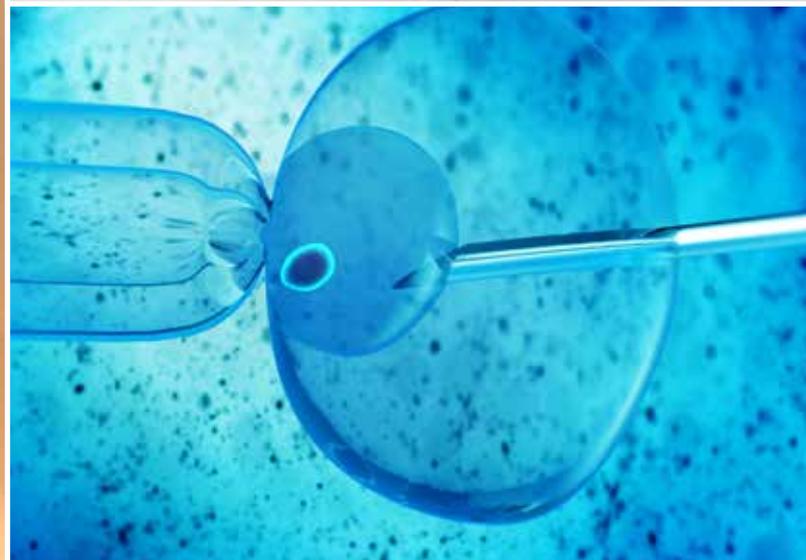
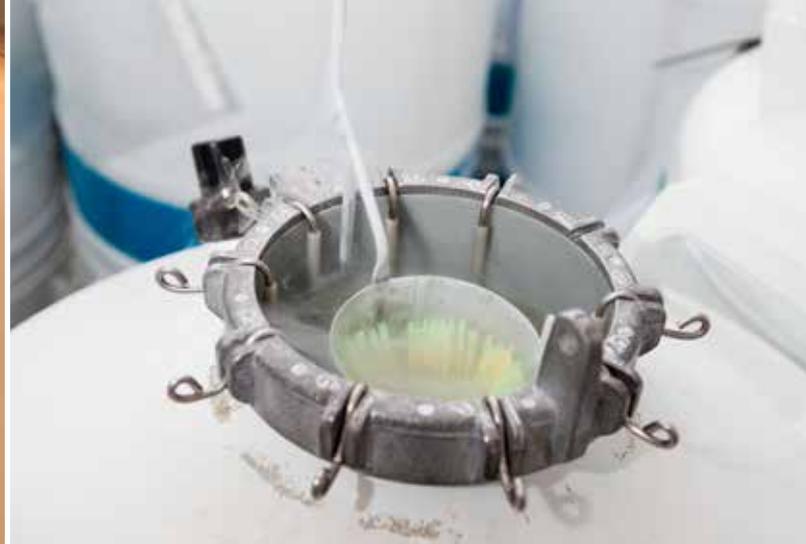




 **UK capability in
livestock and genetics**





UK capability in livestock and genetics

CONTENTS

UK capability and export success

6 UK DAIRY CATTLE

- 6 UK dairy and the rise of the Holstein
- 10 Ayrshire exports to Sweden
- 11 Native Jersey excels in Africa
- 12 Cogent specialise in semen sexing
- 14 Genus ABS dominate globally

16 UK BEEF

- 16 Variety across the beef industry
- 17 Native Angus with world-wide reach
- 18 Hereford success in culinary capitals
- 19 UK Sire Services' 50th export
- 20 UK Limousins become dominant force

22 UK SHEEP & GOATS

- 22 The structure of UK sheep farming
- 25 UK sheep shape world-wide production
- 26 UK Texels top performance in NZ
- 27 Yorkshire Dairy Goats make rapid gain

28 UK PIGS

- 28 The innovative UK pig industry
- 29 Rattlerow develops progressive genetics
- 30 JSR Genetics forges Japanese success
- 31 Deepark grows international trade

32 UK POULTRY

- 32 UK poultry dominate globally
- 33 Hy-Line layers in top global markets
- 34 Cherry Valley's position strengthens
- 35 Aviagen broilers gain more efficiencies

37 UK RESEARCH & INNOVATION

- 37 CIEL for access to UK research
- 38 Roslin grows commercial influence
- 40 Langhill continues long-running trial
- 41 EGENES develops more evaluations
- 42 Agri-EPI connects farmers with research

44 DIRECTORY

- 44 ORGANISATIONS
- 45 COMPANIES
- 46 UNIVERSITIES

Cover image: Greenwell UK Limousin herd, Durham.
Photo: John Eveson.

Foreword

A rapidly growing global population with changing dietary demands and more variable climate conditions means new food production systems with less impact on the environment will be required.

To meet this challenge, the UK has much to offer: 1) as home to world-class science with some of the world's leading livestock and genetics companies; 2) with a progressive livestock industry where farmers are drawing on new genetics and innovation to improve farming systems by reducing inputs and maximising yields to meet consumer demand with more profit; and 3) by creating a dynamic business environment which encourages investment in science and innovation through Intellectual Property (IP), Patent Box and measurements/standards.

This publication highlights the extraordinary capability that exists in the UK's livestock and genetics industry and how this has influenced sustainable livestock production to meet the growing demand for meat world-wide. It's a capability which ranges from the world's leading cattle, pig, poultry and sheep breeding companies exporting new breeding stock, to the UK's world-leading centres of excellence in research and innovation.

Two new Agri-Tech Centres (Agri-EPI and CIEL) are mentioned in this publication. These connect farmers, researchers, technology, innovation and business with open access to world-class facilities for industry to enhance and accelerate business-led innovation. Agri-EPI has a network of more than 120 members (including farm businesses and organisations) and 28 'satellite' farms. CIEL works with 12 of the UK's leading livestock research institutions and a growing network of industry partners spanning the food supply chain.

The UK's livestock and genetics industry is viewed as scientifically progressive, technically advanced and environmentally responsible. The industry is helping to introduce new pioneering technologies into UK and worldwide livestock production systems which ultimately produce the food products that consumers want and need, with strong quality and animal welfare standards.

Many of the companies profiled in the Directory (page 45) are already exporting to overseas markets and looking at new markets or expanding in existing markets.

If you are interested in learning more about the UK livestock and genetics industry, please do get in touch with the Agri-Tech Team in the Department for International Trade (DIT) or UK Technology for Agriculture and Genetics (UKTAG).

Agri-Tech Team, Department for International Trade

The Agri-Tech Team for the UK Department for International Trade is the centre of excellence and first port of call for overseas companies looking for investment opportunities in the UK and for UK-based companies seeking to expand their international business.

The team champions the role of Agri-Tech in strengthening agri-business success in both UK exports and investment and helps drive sustainable intensification of agriculture to provide global access to sufficient, safe, healthy food. The unique hybrid team of private sector specialists and civil servants has experience and knowledge in business, academia and government across the UK global Agri-Tech sector. Key areas of focus are plant sciences, animal health and genetics, aquaculture and precision agriculture, but other value opportunities are supported on request.

The DIT Agri-Tech Team leverages Government support to address barriers to trade and accelerate routes to market for companies looking to export new products in new markets.

Also, as part of the UK Department for International Trade, the Agri-Tech Team draws on the expertise of DIT's global network of in-country experts in over 100 markets.

*Dr Elizabeth Warham FRSB
Lead, Agri-Tech, Department for International Trade*





UK genetics: the foundation of modern livestock farming

The United Kingdom has long been regarded as the stockyard of the world. Livestock breeds have been developed across England, Wales, Scotland, Northern Ireland and the surrounding islands which are now so internationally important that they dominate commercial meat and milk production in many of the world's advanced agricultural

economies. Names such as Hereford and Angus are synonymous with quality beef production; the Jersey cow is renowned for her efficiency and the quality of her milk; the Large White or Yorkshire pig is the foundation of modern pork production; and almost every commercially important breed of sheep can trace its origins to the UK.

And the list goes on. For today, UK livestock producers follow the example of their forebears, and continue to successfully develop and fine-tune not only the British Isles' native breeds, but also those from other parts of the world. Such has been their success that there is now a thriving international trade in breeds which have been gathered from the UK's neighbours and beyond. For example, British Limousin cattle are top performers in the UK and world-wide; UK Texel sheep have topped performance leagues and sale rings in New Zealand; the British Friesian is one of the UK's most popular genetic exports, thriving under a wide cross-section of climates and production systems around the world; and today, we even have a newly registered breed of dairy goat which may yet be the most productive in the world.

Many of these accomplishments are featured in this publication and I applaud UK TAG for not only drawing these success stories to the world's attention, but also for helping UK breeders and breeding companies to build on the export opportunities the future will undoubtedly bring.

Successful breeding often goes hand in hand with excellent health and welfare. And in these areas too, the UK has built an international reputation. The UK's successive Chief Veterinary Officers have nurtured long term relationships with others around the world – all providing reassurance of the safety and quality of the food we eat and the animals we send overseas. And in a commitment to transparency, they provide clear information on the UK's animal health status and importantly, clear evidence of the processes through which our health status is known.

Similarly, we have been applauded for our commitment to animal welfare, as recently evidenced by the Food and Veterinary Office of the European Commission. Their recent evaluation of dairy cow welfare in the major milk producing nations concluded that the UK was the only country with a completely clean bill of health.

A further significant development for the UK industry has been the establishment of species-specific health and welfare sector councils. These industry forums ensure, as far as possible, that all activity is co-ordinated.

Furthermore, we have a Government which recognises the importance of the UK's unique genetic resource, and the independent Farm Animal Genetic Resources expert advisory committee which provides direct advice to Government ministers and the four nations of the United Kingdom.

And finally, our countries undertake world-class science and have a proven track record of successful innovation and its practical uptake. Combined with our unique farm animal livestock population, we are confident this will continue to help support the safe, sustainable and profitable production of high quality livestock and livestock-source food around the world.

Tim Brigstocke

Chairman: Farm Animals Genetic Resources Committee

Chairman: GB Cattle Health and Welfare Sector Council

UK capability in livestock and genetics

The agri-food supply chain, from primary production to retailing and catering, is estimated to contribute £96 billion or 7% of Gross Value Added to the UK economy.

The UK's livestock and genetics industry helps to underpin this industry and has achieved significant improvement since the turn of the 21st century.

Total income from the output of livestock and livestock products (eg milk, eggs) in the UK has doubled from £7bn in 2000 to £14bn in 2017. This has come from over 200,000 farm holdings, utilising 70% of the land space of the UK and has created employment for more than 446,000 people, including the farmers and their families.

Exports play an important role in this production and help create the investments in improved livestock and genetics that have driven this improved performance. The global market value of agricultural input sales, for example, is estimated to be worth more than \$400 billion and continues to show high growth. The Food and Agriculture Organisation of the United Nations estimates that if current patterns of food consumption persist, 60% more food will be needed globally by 2050, compared with 2005-07.

Livestock and genetics are one of the key sectors in UK Agri-Tech which can rise to this challenge. The sector has been very successful in achieving sustainable intensification. 40 years of modern pig breeding has produced exceptional results. It takes 33% less feed to produce a finished pig, 50% less manure is produced per kilogram (kg) of meat and one acre of land produces 350% more lean meat. To put this into context, the amount of land needed to produce a cooked breakfast has been reduced by 70% (Plastow 2007).

This success has been recognised in emerging economies where consumption of meat and in particular pork is increasing. Like China, which has 48% of the world's pigs, an increase in sow productivity of two pigs reared per sow per year would save the equivalent in animal feed of three times the entire UK wheat crop.

Other sectors have made equally impressive advances in efficiency and the UK is home to some of the world's leading cattle, sheep and poultry breeding companies whilst continuing to maintain one of the most diverse inventories of farm animal genetic resources. More than 235 native breeds are listed in the UK Country Report on Farm Animal Genetic Resources 2012.

This success embodies the Royal Society's description of 'sustainable intensification' as a process in which 'yields are increased without adverse environmental impact and without the cultivation of more land'.



The world population is forecast to rise from 6.5 billion in 2007 to 8.1 billion by 2025. Over the same time period, increasing wealth per capita will hasten the current rapid transition to eating meat. The appetite for animal proteins in the form of meat and milk in developed nations has not slowed in spite of much propaganda suggesting otherwise and in developing countries the demand is only set to increase. India for example has ambitious targets for the nutrition of its human population which include a substantial contribution from animal proteins, which will require greatly increased levels of production.

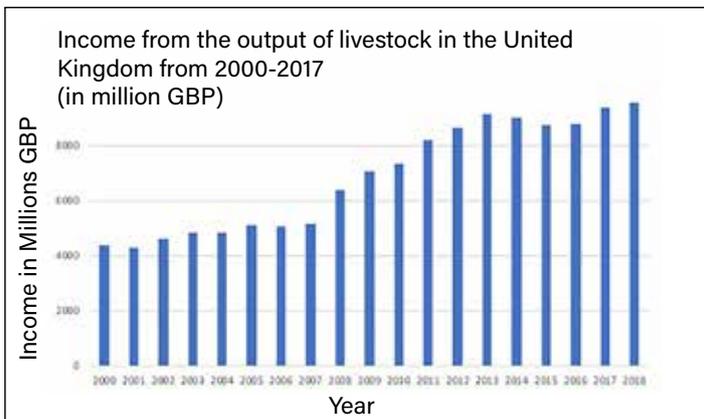
The genetic development of livestock in the UK has been driven by consumer demand along with fiscal pressures. It has, through exports of breeding stock, led to an increase in revenue which has contributed to the successful programmes developed to date by UK universities and specialist research and development establishments which rank in the world's top decile.

This document describes the capability of the key sectors, beef and dairy cattle, pigs and poultry, sheep and goats as well the strength of the UK in research and innovation. Directories of industry organisations, universities and companies are also included.

It is produced in partnership with the Department for International Trade (DIT) and the Department of Environment Food and Rural Affairs (DEFRA) by The Agri-Tech Team for the UK Department for International Trade.

The Agri-Tech Team for the UK Department for International Trade is the centre of excellence and first port of call for overseas companies looking for investment opportunities in the UK and for UK-based companies seeking to expand their international business.

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Free and confidential advice is provided as tailored support to businesses and institutions looking to develop and commercialise new technologies in the UK, for export in the EU and overseas.

The Agri-Tech Team leverages Government support to address barriers to trade and accelerate routes to market, for companies looking to export new products in new markets.

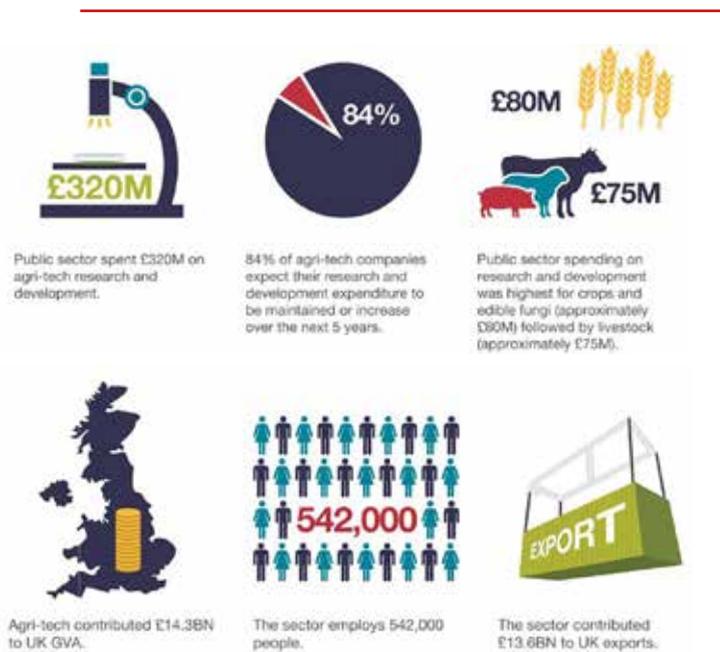
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UK TAG is an accredited partner for the Department for International Trade, helping UK companies to explore international markets and overseas partners to develop trade relationships. Working with industry organisations such as British Livestock Genetics and with support from the Agriculture and Horticulture Development Board (AHDB) and the Department of International Trade (DIT) we organise a comprehensive programme of inward and outward trade missions as well as UK displays and seminars at key events and tradeshows around the world.

We promote all aspects of Agri-Tech from the UK, with special emphasis on Livestock and Genetics. Animal health and welfare are at the forefront of UK Government policies and UK breeding programmes as well as being a high priority for UK consumers. This drives development in sustainable intensification where the UK is a world leader offering a wide variety of production systems that can be used in different environments. The UK is also home to some of the world's leading breeding companies whilst continuing to maintain one of the most diverse inventories of farm animal genetic resources with almost 250 native breeds suitable for use around the world.

For details of our missions and events, information about what the UK has to offer livestock industries around the world and for introductions to UK companies please visit our websites, listed in the directory.



INTRODUCTION

UK dairy cattle and the genetic improvement of the Holstein

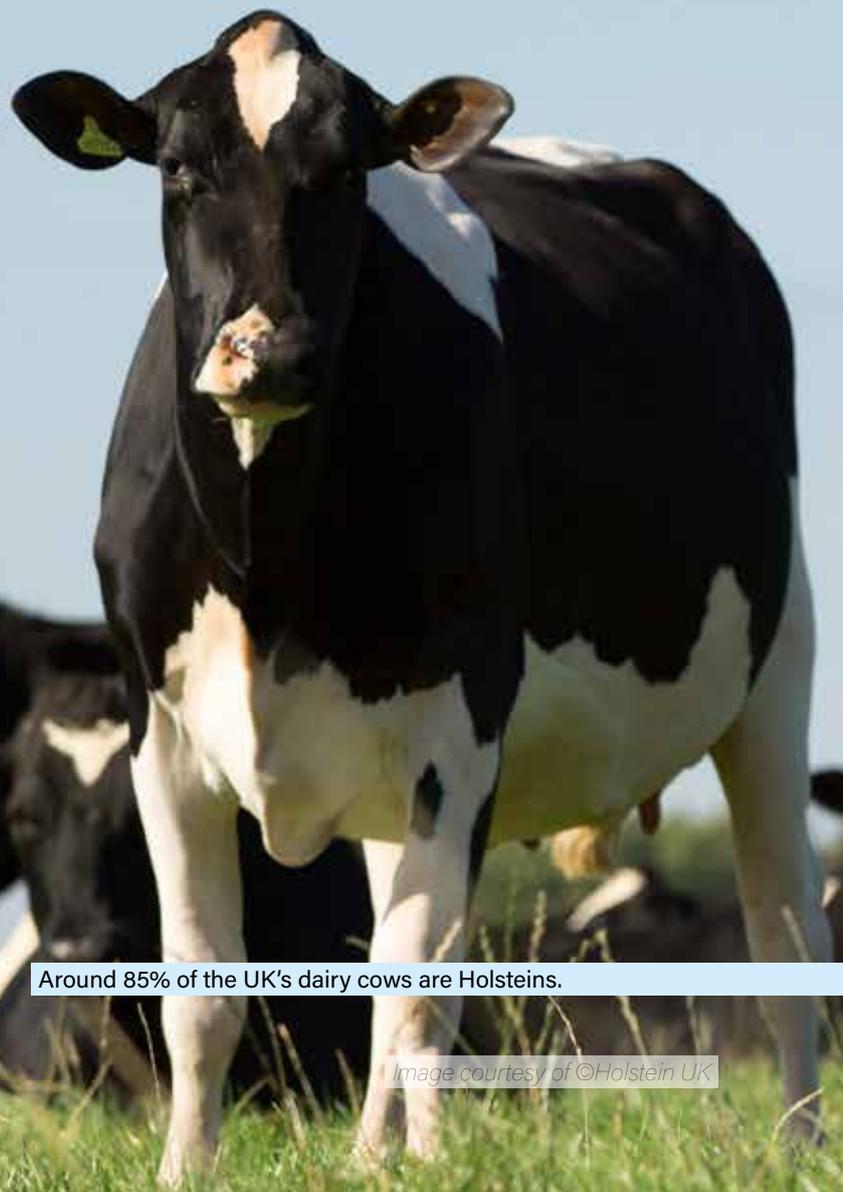
The Holstein dairy cattle population in the UK is built on wide foundations, with influences including Dutch Friesians as long ago as the 1800s, through North American bloodlines from the 1940s and continuing to this day. These influences have been enhanced by incorporating genetics from almost every country in Europe and as far afield as New Zealand, resulting in uniquely British dairy cattle which are suited to a wide cross-section of farming systems.

Today, the Holstein breed dominates the UK's dairy industry, accounting for around 85% of all milking cows. However, it sits alongside its black and white cousin, the British Friesian, which retains a separate section in the herd book and boasts qualities including hardiness and fertility, as well as the carcass characteristics which give its calves and cull cows added value for beef.

The red and white Ayrshire – native to south west Scotland – also has an important place in the UK industry, and was officially recorded as early as the 1870s. Known for the quality of its milk, its longevity and its exceptional udder conformation, it is now found milking in every continent of the world, thriving in both heat and cold.

The Jersey breed originated in the island of

the same name in the British Channel, and has grown to become the number two dairy breed in the world. Renowned for the exceptional quality of its milk, it is increasingly recognised as a highly efficient converter of feed into milk, achieving its production with lower maintenance costs and therefore a lower cost to the environment than any other breed.



Around 85% of the UK's dairy cows are Holsteins.

Image courtesy of ©Holstein UK

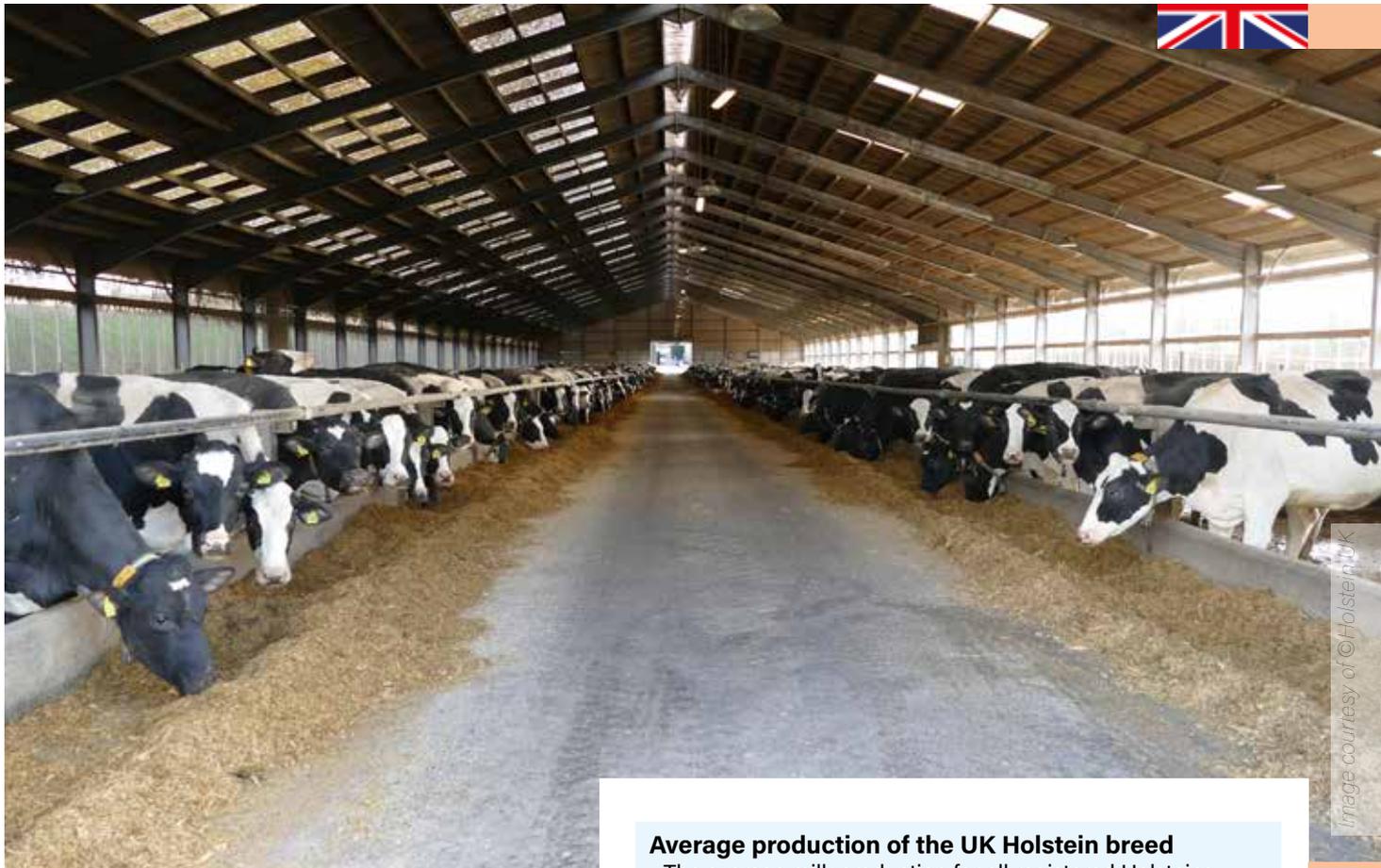


Image courtesy of ©Holstein UK

UK dairy cows are usually housed for part of the year.

Other dairy breeds in the UK are far lower in number and include the native Guernsey and Dairy Shorthorn, alongside Montbeliarde, Brown Swiss and Fleckvieh.

Not only are UK farmers responsible for having developed some of the most important and successful dairy breeds in the world, whose influence has been economically important to many dairying nations, but they continue to develop them to suit 21st century commercial farming systems. This entails producing top economic performance aligned with the high standards of animal welfare which are demanded of British producers.

A strong emphasis on the genetics of health, fitness, fertility and lifespan has played a central role in this process – a trend which is admirably demonstrated by the UK’s Holstein.

It’s a trend which has been delivered through the UK’s national breeding index, the Profitable Lifetime Index (£PLI), which combines milk production traits (34.4%) with those which will improve survival, fertility, legs, feet, udders, calving ability and efficiency (see pie chart on page 9).

The effects of this, and earlier developments, have been seen in the genetics of the national Holstein population. This has improved beyond recognition over the last 10 or more years, seen in some example traits overleaf.

Fertility was impaired across the Holstein population world-wide by a narrow selection for production back in the 1990s. However, it has risen dramatically in the UK over the past 10 years and is now predicted to be back at the levels seen in the mid-1990s by 2024 (see graph overleaf).

Somatic Cell Count (SCC) also suffered as an unintended consequence of strong selection for milk production, but has seen a similar pattern of improvement (reducing cell counts) since the early 2000s (see graph).

Average production of the UK Holstein breed

The average milk production for all registered Holsteins milk recorded with the UK’s three major milk recording agencies (NMR, CIS and Dale Farm) is 9,459kg at 3.96% fat and 3.20% protein (305 days) with a somatic cell count (SCC) of 161,000 cells/ml and a calving interval of 404 days. This includes animals of all ages, including first calvers and cattle farmed across many different systems. Some systems are intensive and fully housed and achieve over 13,000kg of milk and more than 900kg fat plus protein in a lactation. Others have adopted an extensive approach, with most milk produced from grazed grass, little concentrate fed and target milk production of around 4,000-5,000kg. Such herds may be pure black and white, often include some British Friesian bloodlines, or may cross breed Holsteins or completely different breeds.

All milk-recorded Holsteins (87.5% Holstein or more) farmed under this range of systems contribute to the national average, showing the diversity and adaptability of this world-leading breed. Alongside their production is an increasing emphasis on health and fertility, both of which have steadily improved for the past 10 or more years.

Genetic indexes for UK dairy cattle

Dairy cattle genetic indexes in the UK are calculated by the Agriculture and Horticulture Development Board (AHDB Dairy) who also track genetic improvement across the national population for all dairy breeds.

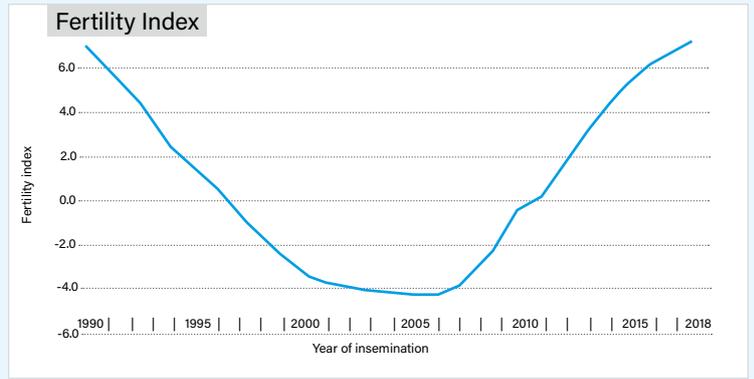
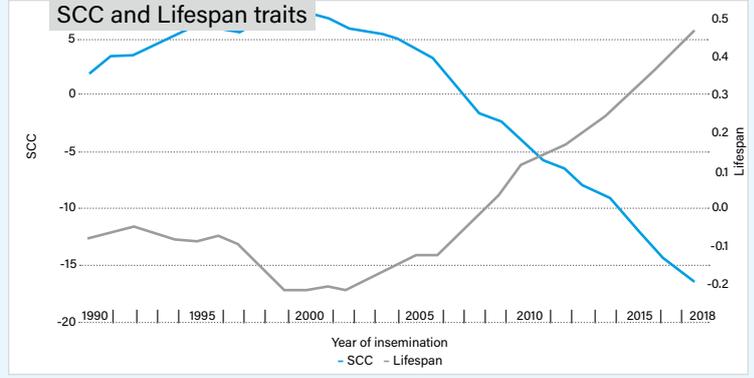
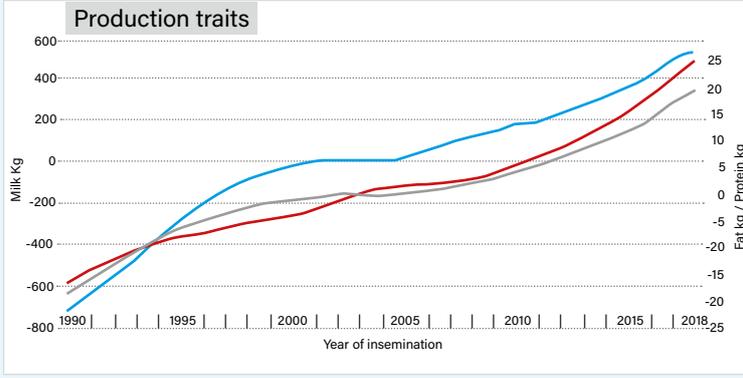
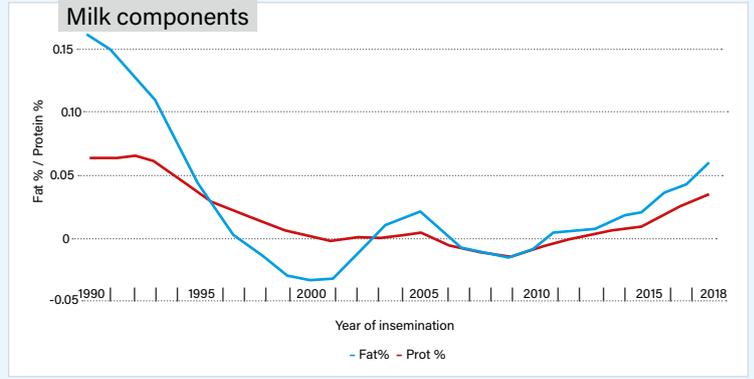
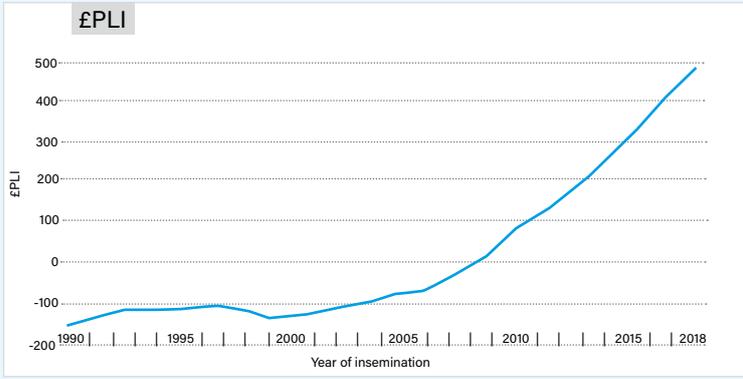
The UK’s main economic index is the Profitable Lifetime Index (£PLI) which is formulated to help farmers breed animals which are more profitable in their lifetimes than the generation before.

The index is reviewed on an annual basis by the AHDB Genetics Advisory Forum (GAF) which comprises breeding industry stakeholders, including farmers and processors, together with breed society, milk recording, animal welfare and AI company representation. GAF considers the genetic progress the dairy breeds are making and the long-term market outlook for inputs and output and it fine-tunes the £PLI and other economic indexes as the need arises.

AHDB Dairy sub-contracts the work of genetic index calculation to EGENES (see page 41).



Genetic trends in the UK Holstein population



Dairy Cattle

Image courtesy of ©Holstein UK

Average production across UK Holsteins is 9,459kg at 3.96% fat and 3.20% protein (305 days).

Lifespan has seen significant improvements in the UK as farmers have been selecting genetics to improve this trait over the past two decades (see graph on page 8).

Maintenance has recently been introduced to £PLI and other economic indexes to help reduce the feed costs associated with milk production. Although maintenance costs have risen in most dairying nations due to selection for large cows, they have now started to plateau in the UK.

All of these improvements to health and management traits have been achieved at the same time as increases in weight of milk, fat and protein. These have risen continuously over many decades, while the last 10 years have also seen improvements in milk quality (see graphs on page 8).

Genomic indexes

Fuelling these improvements has been a significant uptake of two technologies. Around 70% of dairy inseminations in the UK are now made with young sires which have genomic indexes (2018 data), whose calculation is based largely on their DNA. These indexes were introduced commercially to the UK in 2012, and studies have since shown them to be highly reliable, building farmers' confidence in their use. By choosing young sires with significantly improved genetics, particularly for health and fertility, they have been able to make substantial improvements to their business performance.

Sexed semen

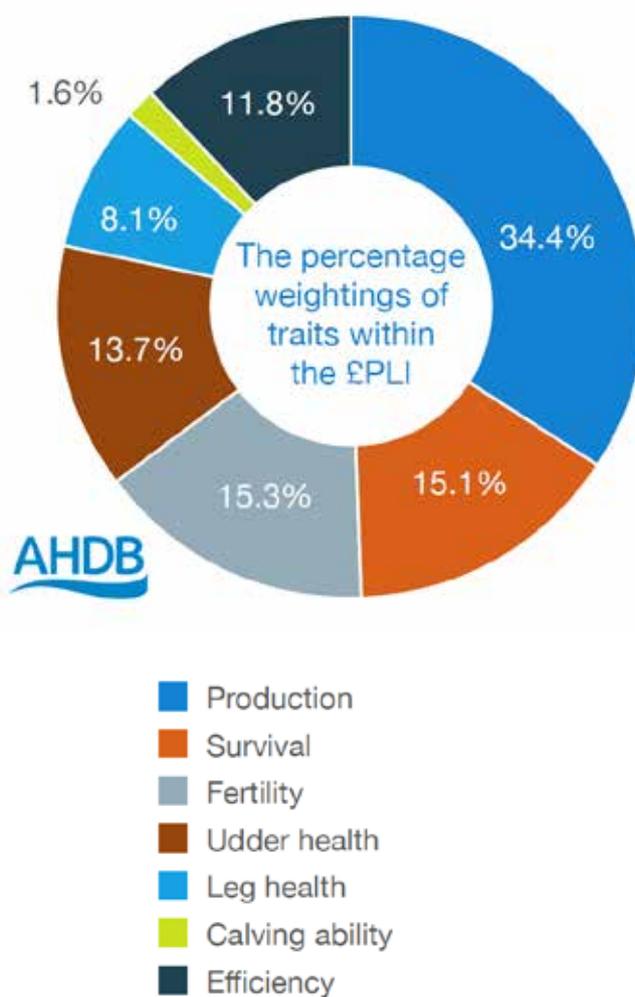
At the same time, the UK was the first country in the world to market female sexed semen which has been used across the dairy industry for over 20 years. In recent years, its uptake has gathered pace, and today it accounts for around a quarter of all dairy inseminations (Apr '17 to Apr '18 figures). This has further increased the rate of genetic progress, allowing UK farmers to breed their dairy replacements from the top end of their herds, while many animals of a lower genetic quality are now bred to beef sires.

This trend has been enhanced by continued improvement in semen sexing technology, which is now allowing some farmers to achieve conception rates which are on a par with those from traditional, unsexed semen.

The Jersey has become the world's number two dairy breed.



Profitable Lifetime Index: the UK's main breeding index



Type classification of dairy cows

Many dairy cows in the UK are type classified to help producers breed hard-wearing, trouble-free, long-living cows. The classification is undertaken for all dairy breeds by Holstein UK, whose data is then converted into genetic indexes by AHDB Dairy. This includes the Type Merit for sires.

As well as the 24 type traits, health and welfare traits (eg locomotion, digital dermatitis) and management traits (eg ease of milking, temperament) are also measured, which also go into the national genetic evaluations.

Specific strengths and weaknesses in the cows' phenotype are highlighted through the classification scheme, which can be used by producers for corrective breeding and (along with genetic indexes) in computer mating programs. An overall grade (eg Very Good or Excellent) is also awarded, as well as a score.

British Friesian classification

The UK's two black and white breeds, the Holstein and the British Friesian, are assessed for type under two different schemes. British Friesians (for 87.5% British Friesian or greater) are scored according to a specific, British Friesian base, on a different scale from the Holstein.



Ayrshire exports to Sweden enhance red and whites

The Troutbeck herd of Ayrshires, Cumbria.
Photo: Sheila Metcalfe.

Many red and white dairy cows around the world can trace their origins to the UK's Ayrshire breed. Developed in Scotland to become a hard-wearing and hard-working animal, today's Ayrshire is considered amongst the hardest of dairy cows.

Having earned a reputation for longevity, ease of management and overall good health, the Ayrshire can now be found milking in every continent of the world.

With more body capacity than many dairy breeds, and an ability to produce high quality milk from forage, she can adapt to all climates – from the heat of Africa to the cold of a Scandinavian winter.

In fact, one Scandinavian farming family has invested heavily in the UK Ayrshire for their farm in Aneby, Southern Sweden.

Klas and Anja Dalhog purchased embryos from the Haresfoot herd in Hertfordshire and the Heydale herd in Derbyshire to enhance their Swedish Reds.

They say: "We were looking for robust animals adapted for a simple system with lots of silage and grazing. The pure Ayrshire cows that we saw in the UK were the kind of cows we had always been striving to breed."

Admiring in particular their udder conformation and longevity, they say the UK cows fit into their grazing system well.

So, they have not only continued to regularly purchase UK genetics for their herd through Ayrshire semen but are also selling it, through their company Svensk Ayrshireavel ek för, to their fellow Swedish farmers.

They say: "Our customers appreciate the UK genetics for the outcross bloodlines and its focus on cow families."



Native island Jerseys make an impact in Africa

Jersey cattle genetics from the Island of Jersey are spreading their way across the tiny African Republic of Rwanda where their introduction is having a profound effect on the standard of living for many rural dwellers.

Jersey-cross cattle are being born in the east-central African country, thanks to the donation of semen by the Royal Jersey Agricultural and Horticultural Society (RJA&HS), supported by the aid agency, Jersey Overseas Aid (JOA), and delivered through the intermediary of the respected specialist charity, Send-a-Cow. The initiative, called Jersey Inka Nziza (meaning Beautiful Jersey Cow), also involves the Rwandan Agricultural Board, with RJA&HS acting as lead partner.

At the outset of the programme, eight bulls from Jersey Island were initially shipped across the English Channel to the independent collection centre of UK Sire Services, for the production of 100,000 straws of semen. These were destined for Rwanda in the first year of the two-year programme, which was later extended for a further three years and is still under way.

Great care was taken to ensure the bulls chosen would transmit good fertility to their daughters, alongside great legs and hard, black feet, good resistance to mastitis, suitable udder conformation with enough teat length for hand milking, and a robustness and ability to lay down body condition when feed is abundant. Most important was the need to ensure no undesirable haplotypes or recessive genes were present in the genotype of any bulls shipped.

At the heart of Rwanda's choice of the Jersey breed was a growing body of evidence showing the so-called red breeds – of which the Jersey is one – fare better than others in the

Rwandan climate. The Jersey also has the benefit of being small in size, meaning its maintenance costs are relatively low.

Furthermore, the Jersey has been shown to cross well with the indigenous Ankole cow, whose daily production tends to increase from around two to 10 litres, with the first Jersey cross. In the second cross, yields increase further to 16-20 litres. It's also important that this is achieved on the often low quality forage available.

The scheme has now been running for two years and dovetails with an extensive AI technician training programme, initially overseen by a retired Jersey Island technician. This has seen the country's base of technicians grow from 19 to around 500, who are now active across the country.

There are challenges still to be faced, according to David Hambrook from RJA&HS who is leading the programme, although he's seen many lives transformed through the acquisition of a cow.

"A widow of the 1994 Rwandan genocide who has worked with Send-a-Cow is a case in point," he says. "She has brought up four children single-handedly, and says that having just one cow has allowed her to put all four through university."

For the future he says that JOA will help build a national cattle database in Rwanda, through which production can be recorded, technician performance monitored and which will assist in producing the ideal cow for Africa.

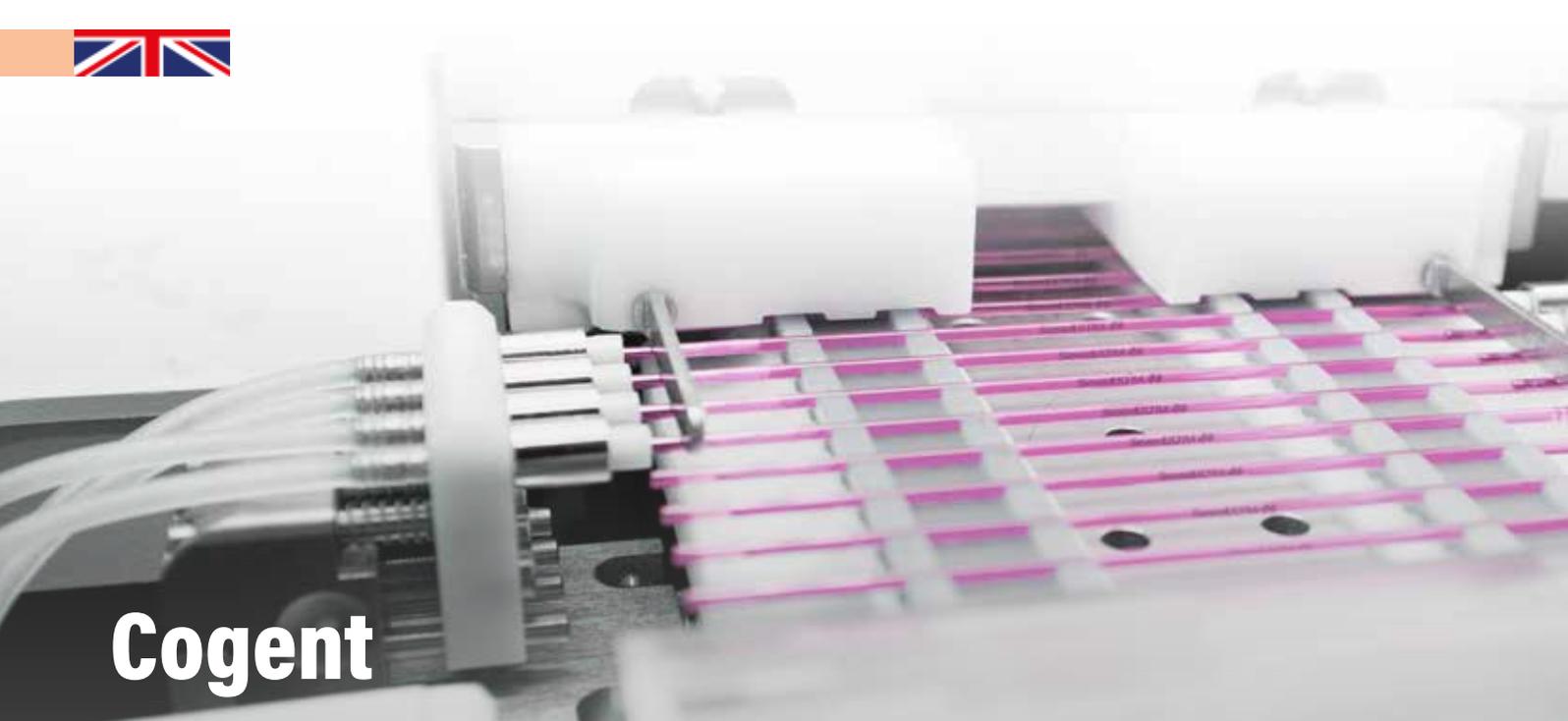
Alongside this, work is under way through the International Livestock Research Institute (ILRI), supported in the main by the Gates Foundation, to help identify the genotypes behind cattle which seem to thrive in typical African and similar tropical conditions.

"I suspect that research will tell us whatever the ideal tropical African dairy cow looks like, and in particular the smallholder farmer cow, it must contain at least some indigenous genes to assist in combating health challenges," says Mr Hambrook. "Furthermore, I am confident it will be a 'Jersey Spice' – a cow which looks and acts much like a Jersey, even if it is not entirely Jersey"

Such has been the success of the scheme in Rwanda, that other countries – mostly in Africa – have expressed an interest, and a similar scheme in Malawi is already in its first year.



Dairy Cattle



Cogent

Specialising in semen sexing technology

Cogent was established in the heart of UK dairying country in Cheshire in the mid-1990s, with the objective of progeny testing dairy and beef bulls. By 2000, it had invested heavily in semen sexing technology, to become the first company in the world to market sexed female dairy semen.

Sexing semen became a specialism for Cogent, to the extent that the company even undertook semen sexing services for some of its own competitors. Now it has links to ST Genetics – owners and world-wide patent-holders of bovine sexing technology – the company continues to keep at the cutting edge of technological change.

Today, Cogent's laboratories at Beachin Stud in Cheshire are the largest for sorting semen in Europe. And the recently launched product, SexedULTRA 4M, which packs four million

sperm cells into every straw, has elevated performance to a new level.

Early independent trials in Germany achieved conception rates with 4M which had never been recorded with sexed semen before. These have since been replicated on commercial farms in the UK which are starting to report conception rates on a par with conventional semen.

It is now commonplace for UK dairy producers to use this high-dose sexed semen on their best heifers and cows, leaving the remainder of their herd to serve to beef.

Such has been the success of the new sexing technology that many UK farmers have virtually eliminated the birth of low value dairy bull calves on their farms.

And because every bull in the Cogent dairy stud is now offered sexed, they can do so without compromising genetic

Dairy Cattle

The Hicks and Jacobs families are achieving high performance from UK sexed semen in their herd in Australia.





improvement in their herds' milk-producing females.

Tom Peters, export manager for Cogent says the uptake of male sexed beef semen has followed on from the dairy success.

He says: "Male sexed beef semen has been one of the biggest growth areas of the past 12 months. With better conception rates from SexedULTRA 4M, farmers now have the confidence to use male sexed semen in their dairy cows.

"This model is gaining popularity in markets within Europe and helps maximise profit per pregnancy. The slight increase in semen costs are far outweighed by the benefit of a far more valuable male beef calf."

Around the world, the use of sexed dairy and beef is gaining ground, typified by the Hicks and Jacobs families who milk 650 cows in partnership in South Australia.

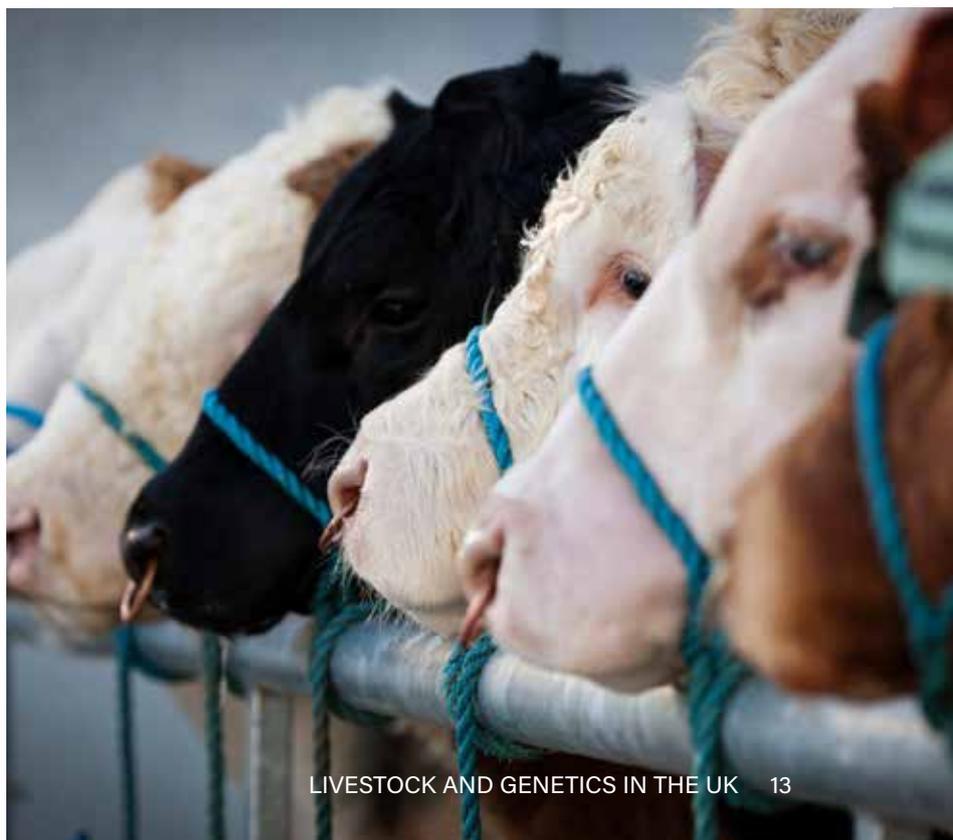
They have opted to calve in three tight blocks, breeding their

herd in February, May and late September, which helps maintain a level milk supply and allows for good hygiene practices between each batch of calves.

In the most recent block, 80 milking cows were served to SexedULTRA 4M which achieved a conception rate to first service of 54%. A smaller batch of 25 cows at a second premises achieved a conception rate of 56%. Conventional semen was used on the remainder of the eligible cows, with the partnership's two dairies each achieving a conception rate of 47% and 55%.

Today, the partners have made the decision to serve all reasonable fertility cows to SexedULTRA 4M, with the balance bred to AI Angus bulls.

They say: "This enables us to cull more heavily in tough years and also export some heifers to provide another income stream."





Genus ABS

A global giant in cattle breeding

Genus grew out of the UK's former Milk Marketing Board to become the largest cattle breeding company in the world. The company acquired ABS Global in 1999, added PIC (formerly Pig Improvement Company) in 2005 and today is quoted on the London stock exchange (FTSE 250).

The company is headquartered in the UK and has cattle studs in the UK, the USA, Canada, Brazil, Italy, Australia and India. Its cattle breeding business, trading in the UK as Genus ABS and in the rest of the world as ABS (with the exception of France where it operates as Bovec), also operates wholly-owned bovine businesses in 20 countries. Representatives in a further 60 countries add to its global influence which sees 17 million doses of cattle semen distributed by the company each year. Some one million of these doses are produced in the UK.

Historically, the Holstein bull, Picston Shottle, did an exceptional job of disseminating UK genetics, maintaining enormous international popularity for many years.

Leading on from Shottle's

legacy, multiple UK-based bulls have secured outstanding international demand. The company also experiences ever-increasing demand for UK-based beef genetics, which goes hand-in-hand with the rapidly growing uptake world-wide of sexed dairy semen.

World-leading bulls in the Genus ABS UK stud are poised for further growth. The company's emphasis is on purchasing bulls for global appeal rather than just simply focusing on the UK. Some of these UK-based bulls which fare particularly well on America's breeding indexes are:

Schreur Shimmer is the number one red carrier sire for TPI and NM\$.



Jane Steel



Friesian genetics reflects the breed's exceptional daughter fertility and its ability to produce milk from grazed grass, and hence, its suitability for seasonal calving systems. Also known for its lifespan and the value of its bull calf, there's a growing appreciation of its ease of calving and management. The number one export bull, Peartree Bryster, features these qualities as the highest genomic index young sire in the British Friesian breed world-wide, ranked on Profitable Lifetime Index (£PLI). A son of Catlane Chad, he has an EX91-classified dam who is due with her eighth calf, while the next four generations have all had eight or more lactations.

China

A relatively new export market for UK genetics is China, where there has been significant growth in demand for dairy genetics, particularly through sexed semen. Recent demand for beef has also grown, creating an interest in beef x dairy. This has seen Genus introduce both British Blue and Angus for beef on dairy in the Chinese market.

Italy

Italy has long been a large export market for Genus with its affiliate business, ABS Italia, having the country's number one market share. As in many markets around the world, sexed semen in the form of Genus's branded Sexcel has grown in popularity, and with it the use of beef genetics to maximise calf crop value.

Salvi Farm, which milks 500 Holsteins in the province of Parma, northern Italy, is a case in point. When the ABS Italia team approached the business about the newly launched BeefAdvantage, the owner, Valerio Salvi, was immediately attracted by the sires available and the economic benefits that using beef on dairy would bring. He now uses Genus ABS beef semen across 70% of the cow herd and has had a particularly good experience using British Blue semen.

Praising BeefAdvantage for improving calving ease

as well as calf quality he says that in the last six months, 250 British Blue calves have been born, with only three mortalities, none of which was due to a difficult calving. The farm sells its calves between 30 and 35 days old at 73-75kg.

Mr Salvi says: "Compared to the previous year, I have had an increase of 40€ per calf in revenue. We have moved from an average of 380€ per calf to 420€. Our buyers are also satisfied, as our calf quality ensures 0.50€ more per kilogram compared to the average market price."

**Bull proofs at the time of going to press*

- DeNovo Invictus: top sire for TPI (Total Performance Index) and NM\$ (Net Merit)*
- DG OH Rubels Red: number one red and white for TPI and NM\$
- Schreur Shimmer: number one red carrier sire for TPI and NM\$

British Friesians

Despite the massive world-wide demand for the company's Holstein stud, Genus's top demand export bull is currently a British Friesian. The popularity of

The British Friesian, Peartree Bryster, is Genus ABS's number one export bull.



Jane Steel

INTRODUCTION



The UK beef industry

Beef in the UK is produced from a range of systems, from extensive grazing-based, to more intensive grain-based systems. The majority of cattle are based in extensive systems, with most animals only being intensively fed in the last 100 days before finishing. In the UK, 65% of farmland is unsuitable for growing crops, and so using this land for extensive grazing of cattle and sheep allows a plant which is not edible to humans to be converted into a high-quality edible protein.

Beef supply in the UK comes from both the suckler herd, and as a by-product of the dairy industry. Currently about 55% of UK beef comes from the suckler herd, with the remaining 45% a product of the dairy herd, be they beef-dairy crosses, or pure-bred dairy bulls.

Suckler breeders may produce breeding bulls and heifers for sale, breed and sell weaned calves for finishing, or take their stock right through from breeding to finishing. On the dairy side, dairy bull calves and dairy x beef calves are sometimes reared by the dairy farmer and finished, but more often sold on to calf rearers, and then finished off for slaughter. Using beef sires on the dairy herd improves the carcass characteristics of the cross-bred calves, and creates an animal more suited to the beef supply chain.

There is a wide range of cattle breeds in the UK, each suited to different production systems. This allows producers to select the most suitable breed/s for their individual system and end market requirements. The native breeds are slower growing and suited to lower input systems, whereas the continental breeds can reach slaughter weight at an earlier age.

Estimated Breeding Values (EBVs) were first published in the beef industry in the early 1990s, and levels of performance recording and traits analysed have been increasing ever since. Breeding values and selection indices are available from three service providers depending on the breed of interest, with the main UK provider being Signet Breeding Services. The British Limousin Cattle Society publish their own evaluations for the Limousin breed.

Indexes

The indexes available vary by name depending on the provider, but the main two indexes are as follows:

Beef Value/Terminal Index

This index gives an indication of the genetic potential of an animal to produce the slaughter generation of offspring. The focus is on fast-growing animals which will produce superior carcasses, and some emphasis is also placed on direct calving ease scores to produce animals which will be calved without assistance.

Maternal Value/Self Replacement Index

This index gives an indication of the genetic potential for breeding good replacement females for the suckler herd. In this index there is more emphasis on the maternal traits such as calving ease, calving interval, age at first calving and gestation length.

Index values provide a good first point of reference for choosing bulls for breeding. However, it is important to look at individual EBVs to select bulls which are superior for traits that require improvement in a particular herd.

Genetic trends show that genetic improvement in the beef industry has improved the quality of the UK beef herd since records were introduced. For example, the median Beef Value Index in Limousin cattle born in 1997 was 10, and for calves born in 2017 it was 30. There is still considerable genetic variation within breeds for the traits analysed, and so there is scope for much more progress to be made.

The majority of EBVs are generated from performance records in pedigree herds, whereas many of the slaughter generation are cross-bred cattle. AHDB Beef & Lamb have therefore recently launched the AHDB National Beef Evaluations, which provide EBVs for traits recorded on commercial animals. The first set of EBVs available are for carcass weight, fat, conformation and age at slaughter, allowing producers to make selection decisions based on the attributes they are paid for. Using these new EBVs alongside existing traits such as calving ease should allow breeders to produce animals which best meet market requirements. These new commercial evaluations will be extended over time to cover further traits of interest, such as calf survival.



Native Angus genetics with world-wide reach

The Dunlouise herd in the county of Angus, Scotland.

Beef Cattle

Aberdeen-Angus cattle are renowned throughout the world as farmers across countless nations have successfully moulded this extraordinary premium beef breed to fulfil their own objectives. But like so many great breeds of cattle, the Angus has its origins in the UK, where it can be traced as far back as the mid-18th century, and to the Scottish counties of Aberdeen and Angus. Here, a handful of progressive farmers refined the polled and predominantly black native cattle from the north east of Scotland until they had true-breeding animals of outstanding quality and character.

Such has been the success of the breed around the world that it now dominates beef production in the USA, Canada, Argentina, New Zealand and Australia. It also remains the most popular native breed and the second most popular beef breed overall in the UK.

Breeders who wish to see Angus cattle in their purest form would do well to visit the Dunlouise herd of Geordie and Julia Soutar. Located in Forfar, at the heart of the county of Angus, it is fitting that here the breed has been kept completely true to its roots.

Founded little more than 30 years ago, when beef was thought by many to have lost the taste and tenderness for which it was once known, the Soutars – together with Bob Anderson, the then secretary of the Aberdeen-Angus Society – set about collecting the original unadulterated Aberdeen-Angus bloodlines.

The cattle they have developed on Kingston Farm, may not have been in vogue in the 1980s when the trend was for taller animals which performed well on grain and laid down little intramuscular or back fat. But today, the demand is

for exactly what they produce – robust and hardy animals which are small in stature but wide in frame, and carry both the intramuscular fat and backfat which confer tenderness and flavour. As demographics have changed and smaller families demand smaller joints of meat, and as the public has become more discerning over the quality of the food they eat, the Soutars' premium beef has become everything required for the 21st century.

It is therefore little wonder that the family regularly sells either semen, embryos or live animals to North America and many South American countries including Argentina, Brazil, Colombia and Uruguay (including 250 embryos to Uruguay in the past year alone), as well as Australia, Switzerland, Germany, France, Italy, Sweden and numerous other European nations and beyond.

The international reach of this herd of just 50 cows belies its small size while the easy-fleshing qualities, easily born calves, mothering ability, and the ability to thrive on any quality of forage and in adverse conditions, have all ensured that sustainable beef from the now trademarked Native Angus is enjoyed around the world.

Back home in Angus, the Soutars continue to produce their cattle in the traditional way, feeding them on grass, silage and turnips and producing a softer, sweeter and more buttery textured meat than that of their grain-fed cousins. Steers finish on this regime – without any concentrates – at an average liveweight of 550kg and carcass weight of 300kg, aged 18 to 20 months.

The cows are long-living, typically producing 13 or 14 calves, while the family works hard to maintain the widest possible gene pool from which their herd, and those of its customers, can continue to progress.



A taste for Hereford beef fuels trade to culinary capitals

As recognition of the quality of Hereford beef rises across Europe, interest has grown in UK-sourced bloodlines to meet the demands of the continent's discerning chefs. Lorraine Hobson, who runs 500 acres (202 hectares) at Marsh Court Farm in Eldersfield, Gloucestershire, has had just the product to meet that demand, and has seen a thriving trade in the poll genetics from her Eldersfield herd. Last year saw cattle depart her herd - which she founded with her late husband, Andrew Hobson in 2000 - destined for France, Belgium and Italy.

This included a consignment of 11 maiden heifers destined for Umbria, Italy, the culinary capital of the continent.

She says: "There's been an increased awareness of the high quality of Hereford beef amongst chefs across the continent, which has been great news for British breeders."

Today, the Eldersfield heifers which left for Umbria are completely settled, grazing extensive pastures with a bell around their neck, and have happily acclimatised to the Italian way of life.

Alongside the heifers, the bull, Eldersfield 1 Pendock, travelled with the ladies as well as a pedigree yearling bull from Colin Powell of the Roughmoor herd, Herefordshire. This broadens the bloodlines and provides the Italian farmer with a wider gene-pool with which to breed his newly established herd.

The reputation of the Eldersfield herd as a source of heifers for start-up herds on the continent has been spread through word of mouth over the years, and Mrs Hobson says she has had nothing but good reports back across the English Channel.

She says she has not had any difficulty in terms of adhering to regulations in order to successfully export the animals, which is helped by the herd's high health status.

As a result, she has also sent 16 home-bred, in-calf heifers to two different farms in the north west of France. Her buyer, who was looking for a beef breed to establish alongside a dairy enterprise and as a replacement for continental breeds, said the Hereford ticked all the boxes.

This included the breed's easy fleshing abilities on a

forage-based diet, its good temperament and easy calving, and the marbled meat, which is tasty and tender and in growing demand from chefs.

A further export from Eldersfield was destined for Belgium last year, when 15 in-calf and maiden heifers were joined by the bull, Eldersfield 1 Pembroke P1286, and a second bull from Martin Jenkins' Appleridge herd, also in Gloucestershire.

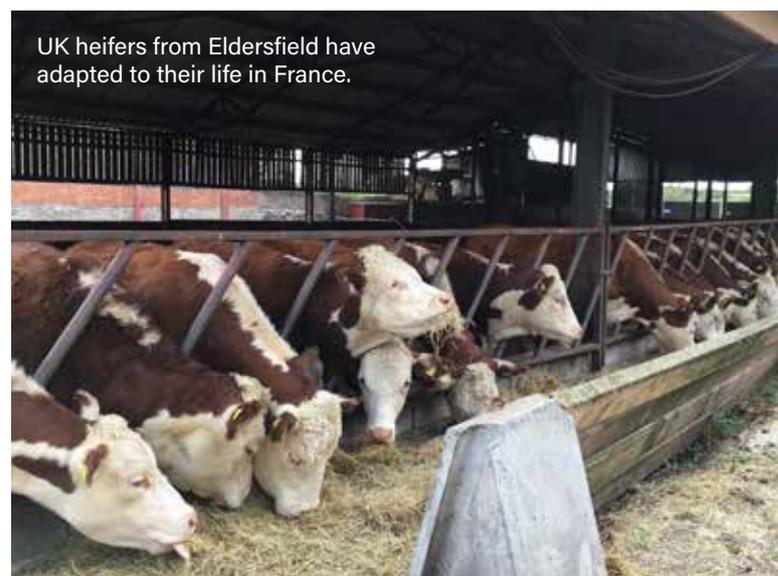
For this buyer, the Herefords were chosen to replace the existing herd of Belgian Blues, because of their beef quality, ease of management, temperament, and ability to thrive on grass-based diets.

Such has been the demand for her stock that Mrs Hobson, who runs her own cattle with the help of farm manager, Dan Goodman, is gradually increasing numbers to around 140 breeding females.

Calving the herd in a 10-week block, she runs five stock bulls but also uses artificial insemination and embryo transfer to further introduce new genetics.

She says: "We are chasing genetics for easy fleshing off forage, easy calving and milk."

Also showing her herd at the Royal Three Counties Show and the National Poll Show, she says this is an essential shop window for her pedigree enterprise.



UK heifers from Eldersfield have adapted to their life in France.



UK Sire Services

Bull semen exports to South Atlantic island

UK exports may have been given some extra impetus by the country's recently devalued currency, but there's one company from the south west of England with an 18-year record of year-on-year export growth. To date, UK Sire Services has sent cattle semen from over 35 breeds to 50 countries, and the 50th export destination was amongst the most challenging, comprising a consignment of native British breed bull semen destined for Tristan da Cunha.

The first step of the journey to this tiny and remote volcanic island in the South Atlantic involved trucking the frozen semen to Manchester Airport in a flask of liquid nitrogen. From here, it was destined for Cape Town, South Africa, and then made the final 2,400km (1,500 mile) leg of the journey by boat. From the island's tiny harbor, the flask concluded its journey to secure storage by tractor.

The semen straws included were from the bulls Albany Ludlow, a pure English horned Hereford owned by Les Cook and family from Cambridge; Fedw Stig, a Red Poll owned by John Williams, a farmer and undertaker from Shropshire; Gear Blue Moon, an Aberdeen-Angus owned by Mark Pilcher, a former Director of UK Sire Services and son of the celebrated late writer, Rosamunde Pilcher; and Morlais Dewi

Saint, a Welsh Black owned by Hywel Davies from near Merthyr Tydfil in South Wales.

The eclectic mix of genetics was chosen for use on Tristan's own mostly Hereford and Angus cattle, with the aim of improving productivity for both meat and milk. The native British breeds were selected for their ability to thrive on limited supplies of grazed grass and for their ease of management in sometimes challenging conditions.

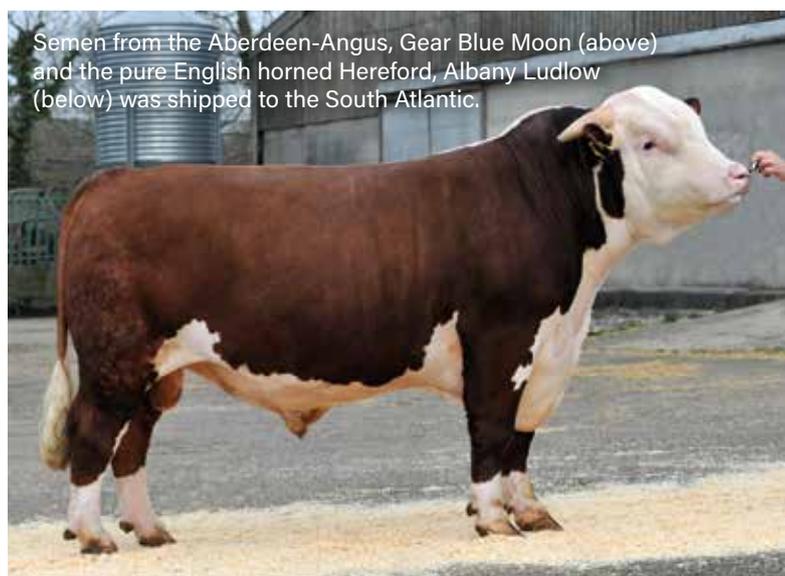
Neil Swain, who works for Tristan's Department of Agriculture and formerly studied at Harper Adams University in Shropshire, UK, instigated the shipment. He said: "Although we keep some bulls from our best cows for breeding, we hadn't had a change of breed for about eight years, so wanted to bring in some new blood."

Mr Swain worked with Joe Hollis, the island's only veterinary surgeon, to inseminate the island's cattle during the breeding season through January and February. Neil became an insemination technician when he was training in the UK and was delighted to have received the semen shipment after its complex and tortuous trip of over 10,000km (over 6,000 miles).

The results were a great success. Not all the island's owners wanted to use AI but the conception rate to standing heats was 68% and the resulting progeny look very promising. Two Aberdeen-Angus bulls were also imported in 2017, and it was also decided to retain two bulls of different breeding, one sired by the imported Red Poll, Fedw Stig, and one by the Welsh Black, Morlais Dewi Saint. These bulls are now being used during the current breeding season.

Rob Wills, Director of UK Sire Services, said: "We thoroughly enjoyed the challenge of exporting to such a remote part of the world, through the authorities in South Africa and then by boat to Tristan.

"The fact that this was the 50th country or dependency UK Sire Services has exported to is something we are very proud of as well!"





Limousins use genetics to become dominant force in beef

Heifers at Whinfallpark.

In 2014, the British Limousin Cattle Society adopted a 10-year Breed Improvement Plan, which would ensure users of Limousin cattle captured optimum value from the genetics they used, in ways that hadn't been possible before.

The Society considered it crucial that as markets change – which they inevitably do – the breed would be in a position to respond favourably to those changes, for traits that were identifiable, measurable and exploitable. Because the Limousin is numerically the largest beef breed in the UK within both the slaughter and cow populations, any genetic change that happens within the pedigree population impacts considerably on the supply chain.

To date, the value of the research and development work the Society has engaged in and co-funded is in the region of £3.4 million.

The 10-year plan

Following industry-wide consultation and planning, the Society's 10-year plan identifies 10 key areas for investment (see diagram below). The necessary work has commenced and, in some cases, has been fully delivered:

Genomic Breeding Values (GEBVs) for carcase traits:

Age to slaughter, carcase weight and six prime cuts (fillet, striploin, rump, topside, silverside and knuckle) as well as a Retail Value Index based on the prime cuts. Work within the project established that the difference in value between high and low genetic merit animals (top third v bottom third) from the prime cuts alone is in the region of £150/head.

For age at slaughter, the genetic difference between the top 1% and bottom 1% animals is 44 days. A quick calculation suggests the faster finished animals could be worth approximately £80 more (44 days at £1.80/day finishing cost) than their slower contemporaries.

GEBVs for female fertility (maternal) and calf survival traits: Age at first calving, calving interval, longevity and calf survival. Previous work from Scotland's Rural College (SRUC) has identified advantages in the region of £42 per year per cow mated from annual re-breeding success and producers can now reliably source breeding stock with the genetics more able to deliver this.

EBVs for feed intake and feed efficiency: The Limousin is the primary breed in an ongoing £1.75m project, co-funded by DEFRA and AHDB. The end point will see Limousins have EBVs which identify favourable and non-favourable genetics for feed efficiency. Work carried out to date in the UK suggests cost savings from feed-efficient cattle in the

The 10-year plan identifies 10 key areas for investment



The plan is taking shape!





region of £30-40 over a 180-day feeding period, representing up to 20% of the total feed cost.

The plan is taking shape!

Whilst it is unrealistic to anticipate that any sector player can capture and exploit all available benefits, the first movers are already benefiting from use of the new breeding values. The work to date has also provided a pathway that will enable the roll-out of further investment and activity within the other goal areas of the Breed Improvement Plan. This will 'future-proof' the breed's performance in all sections of the supply chain and ensure that when market change comes, producers have the means and the genetics to quickly respond and adapt their businesses.



UK Limousin success in Australia

Keystone Genetics, an independent breeding company in Australia, has been importing UK Limousin genetics for 20 years.

Owner, Tim Keys, says: "We believe UK genetics are the best source of high yield genetics which will enhance the carcass traits of the cattle and herds we partner with in Australia.

"We target the heavy-muscled, high yield qualities UK genetics provide and are pleased that demand for the type of animal produced continues to grow.

"The Australian beef market has a very diverse range of end users, both domestic and export. Utilising UK genetics has enabled us to take a leading position in the supply of semen and bulls to producers targeting the vealer market (finished animals slaughtered at 9-10 months for domestic consumption) and also the growing Asian market looking for low fat, high yield carcass bodies.

"We anticipate the Asian market will continue to see significant growth and that subsequent demand for UK style genetics will continue to expand."



Keystone Genetics have been importing UK Limousin genetics to Australia for 20 years.

Beef Cattle



UK breeding success in US show ring

A son of UK-bred and owned Ben Lomond Mhordhu (pictured) was awarded the Galloway Grand Championship at the National Western Stock Show at Denver in 2019. Mhordhu is bred by Duncan Maxwell on the shores of Loch Lomond, Scotland; his son is pictured after taking the Championship (inset).





INTRODUCTION

Sheep farming in the UK

The British Isles - from the Scottish Highlands to the Welsh valleys, the rolling green pastures of England to the lush grassland of Northern Ireland - are ideally suited to sheep farming. A wide variety of farming systems and sheep breeds thrive on these islands, all relying on the UK's unique ability to produce high quality grass and forage.

Sheep in the UK graze for the vast majority of the year, being housed briefly at lambing time in some (but not all) situations. Supplementation is often with home-produced forage with small volumes of mass-produced feed used in specific circumstances. Sheep farming often takes place in the less productive areas of the country where the land is too wet, too high or the soil of too poor a quality for many alternative uses. This means the UK sheep industry contributes high-quality meat and world-class genetics while also managing the environment and sustaining rural communities in large areas of the country that would otherwise be unable to contribute to food production, the economy or society.

Many of the iconic rural landscapes in the UK would not look as they do without sheep farming and our farmers are incredibly proud of their multi-faceted role in leading the world in sheep breeding and production while also caring for the environment and rural sustainability.





Sheep



UK sheepmeat production

Sheep farming has played an important role in Britain since historical records began – from pre-industrial times when sheep were an essential part of a pastoral society, producing meat, milk at times, and wool and skins, to a more industrial era when much of the country’s wealth was based on wool and textiles.

Although the UK still produces excellent sheep milk and wool-related products, sheepmeat in the form of lamb is now the primary output from the sheep industry. Its place in the market is as a premium and high-quality product, renowned around the world.

The UK is a major player in the global sheepmeat market, accounting for 2.67% of the global sheep population. Only China, Australia and New Zealand produce more sheepmeat, which is an impressive feat for a small country with a large human population – and evidence of the UK’s ideal conditions for breeding and producing sheep.

The UK flock, with around 34.8 million sheep, is larger than that of any EU country, accounting for more than 25% of the EU total. However, its sheepmeat production represents a third of that produced in the EU, indicating the efficiency with which UK producers operate.

The UK exports up to 40% of its sheepmeat, most destined for the EU, particularly France, Germany and Belgium. However, UK sheepmeat exports are flourishing in terms of volume and value, seeing a 14% increase in 2017, mainly driven by non-EU destinations and reflecting



the phenomenal growth in demand from Asia. Buyers trust the safety and reliability of UK sheepmeat exports, which is based on strong domestic regulations and assurance standards for animal welfare, environmental credentials, traceability and food safety. They also chose British sheepmeat as a high quality, nutrient dense and delicious food produced mainly from grass and forage.

The stratified structure

The UK breeding flock stands at roughly 15.2 million adult animals with around 90 different breeds and crosses used. The resulting diversity has evolved organically, reflecting breeders' differing interests and the wide range of topography and climate found throughout the UK.

The commercial sheep industry is based on a stratified or three-tier system, dependent on selection of stock to suit a particular altitude, grazing and production system. The first tier is in the uplands, which is the habitat of breeds such as the Scottish Blackface, Swaledale and Welsh Mountain. Due to the extreme terrain and weather conditions, mountain and hill breeds tend to have one lamb per season for around four seasons. They are transferred as draft ewes to the milder climate of lower areas where they are crossed with longwool breeds. The female offspring of the mountain and hill breeds are retained as pure breeds for breeding stock. The male lambs and any surplus females are sold to upland or lowland farms to be finished or reared for meat production.

The second tier is draft mountain ewes being crossed with longwool breeds such as the Border Leicester or Bluefaced Leicester to produce a wide variation of half-bred breeding females or Mules. The final tier is the commercial farming of Mules in lowland areas of the UK, where the cross-breeds from the uplands are bred with lowland terminal sire breeds, such as the Suffolk, Hampshire Down and UK adaptations of continental breeds, such as the Texel, to produce prime lambs for slaughter.

This stratified system makes economic sense because it utilises the natural resources of British topography, matching breed characteristics to the environment. It also makes biological sense because it makes use of the hybrid vigour of the cross-bred animal.

While stratification is a successful production system and forms the backbone of UK sheep production, there are also many sheep farmers who operate closed flocks.

Within the stratified system and closed flocks, UK sheep farmers operate with world-leading animal health and welfare standards including well-established, veterinary certified accreditation schemes for a variety of diseases.

Trusting British exports

The UK has a long-established history for exporting sheepmeat and genetics, and the regulatory framework and additional assurance standards to ensure exceptionally high standards of animal health and welfare for live exports and traceability and food safety for meat exports.

Excellent safeguards are in place against exotic disease outbreaks (both farm-to-farm and at our ports and airports), including a good surveillance system and clear, effective and well-rehearsed control plans for disease outbreaks.

National Sheep Association

The National Sheep Association (NSA) is the primary organisation representing the voices and interests of sheep farmers in the UK. It has existed since 1892 as a forum for progressive sheep breeders and commercial producers to discuss their respective views and improve the management of sheep, as well as providing a strong and common voice for the industry.

NSA receives no Government funding or levies on meat or wool, relying instead on the annual subscription of its farmer-based membership and fund-raising activities. NSA does not hold a flock book, as these are held by individual breed societies. However, nearly all UK societies, flock books and associations are affiliated to NSA, so it maintains an up-to-date database of relevant and accurate contact details for these groups.

The NSA website has a 'know your sheep' section, listing the attributes of around 80 sheep breeds whose societies are affiliated to NSA. This pictorial guide is a useful resource for farmers looking for commercial information and the general public wanting to increase its sheep knowledge.



UK-bred Border Leicester and Texel lambs in Sweden.



The UK shapes sheep production around the world

The British Isles have earned a reputation as the stockyard of the world, and nowhere is this more apparent than in the sheep industry. British breeds are familiar to producers across the globe, with almost every commercially important breed tracing its origins to the UK.

For example, the Romney breed from the county of Kent dominates the New Zealand sheep industry; the Hampshire Down is a successful terminal sire in many countries around the world and the Suffolk has been a long-term commercial success across North America and beyond.

With the largest sheep industry in Europe and one of the largest in the world, the UK continues to shape sheep production at an international level. Today, it does this with a wide cross-section of breeds including the traditional and modern, the specialist and commercial, and with dairy as well as meat breeds.

Breed improvement continues at a pace, with a significant proportion of UK producers tapping into modern breeding techniques. AHDB Beef & Lamb oversees the calculation of genetic evaluations which are undertaken on their behalf by EGENES at Scotland's Rural College (SRUC).

Evaluations are calculated for a wide cross-section of traits encompassing growth and carcass characteristics of terminal sire breeds, alongside milk production, maternal care, prolificacy, lifespan and an increasing number of health traits.

For more than 20 years producers have tapped into CT (computed tomography) scanning, which assesses whole body composition and has added a depth of information previously unavailable. Estimated Breeding Values (EBVs) for lean weight, fat weight and gigot (leg muscle) weight are all calculated from this process while EBVs for a variety of traits such as eye muscle area become far more accurate when using CT in the process. Similarly, the reliable measurement of intra-muscular fat is helping to ensure the eating qualities of lamb are retained and improved.

While only a small proportion of producers would engage with CT scanning, many more use ultrasound on farm for performance-recording. Furthermore, the genetic influence of the top animals which are CT scanned spreads quickly through the UK's national population through artificial insemination (AI) and embryo transfer (ET).

Animal Breeding Europe undertakes around 70% of the AI and ET work in the UK sheep industry and says there's a growing interest from international buyers in acquiring UK genetics.

James Mylne is one of the company's vets and estimates around 30,000 ET lambs are born in the UK each year.

He says: "The UK is a world leader in genetic improvement

and artificial reproduction for sheep, which explains the level of demand there is for UK genetics world-wide."

Recent shipments from AB Europe include:

Beltex embryos sold to New Zealand, producing rams which have sold at auction for up to NZ\$22,000, a breed record price.

Embryos and semen from UK milking sheep have sold to New Zealand as part of the country's major ongoing investment in producing small ruminant milk products for the Chinese market.

Spain and Portugal take a regular supply of UK Suffolks, with AB Europe undertaking the ET work on site.

UK-sourced Swiss Valais Blacknose semen and embryos have been exported to the USA and New Zealand, fuelling a thriving global trade in the breed.

Clients in Mexico, Argentina and Brazil have ordered semen and embryos from the Hampshire, Texel, Beltex, Charollais and Suffolk breeds for delivery in late 2019.

He says: "The UK has developed or improved around 40 breeds of sheep which have been selected for a variety of different traits over hundreds of years, many of which have figures to back up their performance. Genomic testing is about to speed up this process further and will help ensure UK genetics remains in keen demand."

Exporter, Mike Adams, who has exported sheep genetics for over 30 years confirms the recognition of UK breeds world-wide.

He says: "The diversity of British sheep breeds, the care and skill of our breeders, and the rules and protocols we adhere to means that we have reliable genetics and healthy breeding stock which are of use to almost any country looking to develop its sheep industry.

"The British sheep industry is also open and transparent, and addresses any health problems it faces through strict Government protocols and controls."

There's a thriving international market in UK sheep semen.





UK Texel sheep top performance in New Zealand

MacG
Aug 18

UK-bred Vaughan Yardstick has become the highest performance-recorded Texel ram in New Zealand.

It was around 25 years ago that Herefordshire farmer, John Vaughan, turned his hand to breeding Texel sheep, and he did so with a wealth of livestock experience as one of the best breeders of Hereford cattle in the UK.

Applying that experience to sheep breeding, he bucked the trend at the time for producing 'compact and chunky' animals, instead preferring to add length to the Texel breed and bring more refinement to its head.

"I was completely at odds with many other breeders who were producing a different kind of animal," he says. "The best meat in the animal is along the spine so my focus was on increasing that area."

Mr Vaughan bred his sheep to be longer in the body and have more eye muscle area, and he was early to take up performance-recording to analyse every aspect of his flock's conformation and performance.

"I also knew that a smaller, more refined head and a longer neck would produce easier lambings," he says.

Continuing in this vein, his animals made their way to the top of the performance rankings in the UK, excelling, for example, for a cross-section of traits including the all-important Terminal Sire Index.

The ram, Vorn Yardstick, made history when his semen was then exported from the UK to New Zealand where Mr Vaughan was confident he would suit New Zealand farming systems.

In the UK, Yardstick had excelled, producing lambs born in the heaviest 10% for the breed and having lambing ease

figures in the top 15%.

"One only has to look at his picture to see the reasons for this," says Mr Vaughan. "His length of neck ensures the lamb's refined head comes out before its well-laid shoulders, with the majority of the extra weight coming in the length of spine."

Remarking that Yardstick is close to what he was aiming for when he started breeding, it is notable that seven of the eight animals in the ram's pedigree bear his own Vorn flock prefix.

By 2018 Yardstick had sufficient progeny in New Zealand to have a robust genetic index which earned him his place as the country's number one Texel sire. His Terminal Sire Index of 2108 was far ahead of the second ranking animal, whose index was 1946.

Furthermore, three of his sons are in the top 30 of New Zealand's 388 currently recorded Texel sires. One has sold for the highest auction price in New Zealand this year at NZ\$8,000, while the four Yardstick sons on offer averaged NZ\$5,375.

Yardstick and others from the Vorn flock continue to excel in performance and create a keen demand, with bloodlines now exported to China, Switzerland and Germany, amongst other nations, while more is destined for New Zealand.

A report from the New Zealand Sheepbreeders Association publication stated: "The opportunity to widen the genetic base of New Zealand Texels using top sires from the many times larger British Texel genetic pool is an exciting one."



Yorkshire Dairy Goats become fastest-improving breed

When Angus Wielkopolski first started milking goats over 30 years ago, he could scarcely have imagined that his small herd would expand to 10,000 head; double its milk production or that he'd create his own breed.

But today, Yorkshire Dairy Goats represent a staggering 20% of all milking goats in the UK, and form one of the largest herds in the world. They were recognised as a breed in the UK in 2017 and are now shipped around the world – in the form of semen or embryos – to enhance the performance of dairy goats in a cross-section of nations from the USA and Europe to as far afield as New Zealand.

Driving the breed's popularity is the genetic progress it has made. Milking around 8,000 goats on any one day and performance-recording every animal, the goats are in the rare position of supplying infinite amounts of data from a single management system.

As any geneticist would testify, having data from one system irons out many of the external influences on performance and is a gift when it comes to genetic evaluations.

So, when Mr Wielkopolski got together with the genetic evaluation unit, EGENES (see page 41), in 2013, both parties saw the potential of what could be achieved.

"We set up the first project and when we sent the data to EGENES, they said they had never seen so much in terms of data quality or quantity from a single farm," says Mr Wielkopolski.

Closely studying performance and pedigrees, the team at EGENES calculated Estimated Breeding Values (EBVs) for a cross-section of traits, initially focusing on milk production and a flat lactation curve – an important contributor to efficient milk production in view of the goats' two-year interval between kidding.

The EBVs shaped the ensuing breed improvement programme and in time, conformation traits which would give the animal robustness; health traits such as mastitis

resistance; and lifespan were all added to the mix.

With an in-house progeny testing programme, genetic progress reached an impressive 4% per annum and performance continued upwards.

Fast forward to today, and that genetic progress has doubled to 8% and is on the cusp of rising further – thanks to the introduction of genomic indexes.

Calculated from the goats' own DNA and of particular use for the traits which aren't expressed until later life, the genomic EBVs have allowed sires to be used with confidence at a younger age.

"Before genomic indexes we wouldn't really have any information on the breeding potential of a male until he was past his prime," says Mr Wielkopolski. "But now, he could have 20 sons, 20 grandsons and 100 daughters in milk by the time we would have had the first progeny test results in the past."

The jewel in the crown for Yorkshire Dairy Goats is a genomic EBV for feed efficiency. A trait which has so far eluded the dairy cattle industry is already being calculated for this Yorkshire herd, whose feed intakes are each individually recorded with out-of-parlour feeders, while the animals are weighed every time they visit.

"There's a lot of variation across this trait so I think that in time we will be able to make significant genetic progress," says Mr Wielkopolski.

Yorkshire Dairy Goats

Defined as a 'stable hybrid', the YDG originated with the:

- Saanen for its high production
 - Toggenburg for its good legs and robustness
 - British Alpine for its flat lactation curve
- ...amongst their other qualities.
- Milk is all sold to St Helens
 - Herd average is 1,600 litres/annum, 3.95% fat 3.00% protein
 - The best animals reach 3,000 litres/annum

INTRODUCTION

The UK pig industry

The world population is forecast to rise to 8.6 billion by 2030. Over the same time period, increasing wealth per capita will hasten the current transition to eating meat. Pigmeat is the most highly consumed meat in the world today, offering significant advantages over meat from ruminant species. Its production is more than 180% more efficient and sustainable than intensive feedlot beef and more than 220% more efficient than intensive fat lamb production.

The British pig industry is internationally competitive and produces outstanding breeding stock and a range of convenient, healthy, tasty and safe pork and pork products. It has an international outlook that enables it to embrace new ideas and compete effectively and exploit the high welfare standards of national production which continue to set the UK apart from virtually every other country. The industry also ensures pig production continues to make a positive contribution to the environment, with low methane emissions and the recycling of non-meat co-products from the manufacture of human food and drink.

Rising productivity

The increase in productivity from British pigs has been spectacular over the last 40 years. The number of pigs produced per sow per year has increased by 50%, while pigs eat some 33% less feed and produce more than 33% more lean meat. Overall, on a per tonne of feed basis, there has been more than a doubling of the amount of lean produced and a greater than 50% reduction in the amount of manure produced per kilogram of lean produced. As a result of these improvements, the costs of production have been significantly reduced and there has been a major reduction in the environmental footprint.

These gains have been achieved through improved management, nutrition, health and, in particular, genetics. Genetics is the first limiting factor in productivity and the British industry has led the world in pig genetics through the innovative and practical exploitation of quantitative and molecular genetics and the emergence and success of the world-renowned specialist pig breeding companies. These companies have been the focus of global pig improvement through the exports of British genetic material around the globe.

Science and technology

The advancement and rapid evolution of the UK pig industry has been underpinned by world class science. There has been an exceptional record in the uptake of new technology as well as massive cost benefits from government and international industry-sponsored research and development.

We live in a highly competitive global market, not just for food resources but also for technical services. Our success in the UK is shown by the fact that UK pig genotypes consistently out-perform overseas competitors in independent international comparison trials.

British pig breeding companies are totally committed to continuous technical development, the optimisation of genetic progress and the attainment and maintenance of competitive advantage. This is achieved through maximising hybrid vigour, having different selection objectives in sire and dam lines, utilising accurate performance-testing, exploiting optimised selection indexes in different markets, using advanced multi-trait BLUP (Best Linear Unbiased Prediction) models, matching nutrition to genetic potential and the rapid uptake of new technologies using genomic selection.

Our companies have combined their genetic skills with those of practical breeders to ensure genotypes are bred for the best phenotypes in terms of conformation and type while attention to good legs, feet and under-lines is considered fundamental. As a result, UK pigs enjoy a robust longevity. In particular, companies listen carefully to their customers' feedback and incorporate this information into breeding plans to ensure products are tailored to individual market requirements.





Rattlerow Farms

Quality pig genetics - on the hoof and in a test-tube

As trusted exporters of quality breeding stock from the UK, Rattlerow Farms have a long history of successfully establishing pig breeding programmes around the world. Rattlerow gilts, boars and semen for artificial insemination (AI) have been exported to Asia as well as to European countries and the USA.

The company's European business, RASE Genetics, has also exported to South America and the Far East. With its experienced export team, it manages the process of exporting Rattlerow's progressive genetics around the world with ease.

Rattlerow Farms is one of the largest and longest established, privately owned and entirely independent pig genetics businesses in Europe. Since 1954 the business has continually invested in its genetic and high health programmes, making significant economic advances for producers, processors and retail customers within the global pork market.

The company operates breeding farms in Belgium, Hungary and China as well as in the UK and runs AI studs in the Netherlands and the UK.

Sire and dam lines

Rattlerow combines quantitative sciences and biotechnology, in a balanced approach to pig development. Through its owned nucleus and multiplication farms and licensed boar studs, Rattlerow and its sister companies, RASE Genetics and Klasse Ai, are able to supply a wide range of genetically advanced sire and dam lines which will add value to each level of the pigmeat supply chain.

The pure-bred dam lines that make up the Rattlerow parent gilt range have been selected from our nucleus herds for high numbers born alive and weaned, regular breeding and mothering ability. The breeding programme uses BLUP analysis across a large population of nucleus animals from many Rattlerow herds. This approach ensures parent gilts are both highly productive and

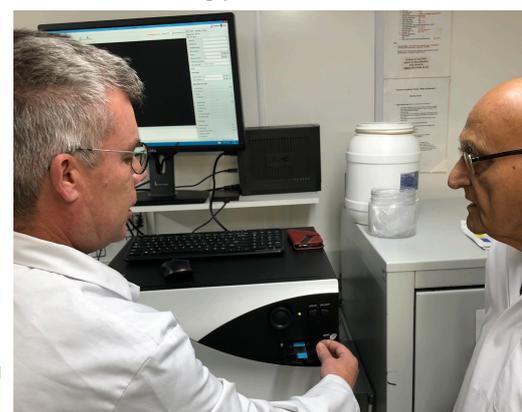
capable of producing large, uniform litters. Strict selection of stock focusing on teats, feet, legs and body conformation is recognised as a key component in delivering a quality product.

Klasse Ai has been at the leading edge of genetic transfer through the use of AI for many years and has become an unrivalled leader in the collection and processing of boar semen in the UK and Europe. Experience gained from building and running AI studs and breeding farms around the world has helped to ensure its customers continue to have superior products of the highest health status and advanced technical support.

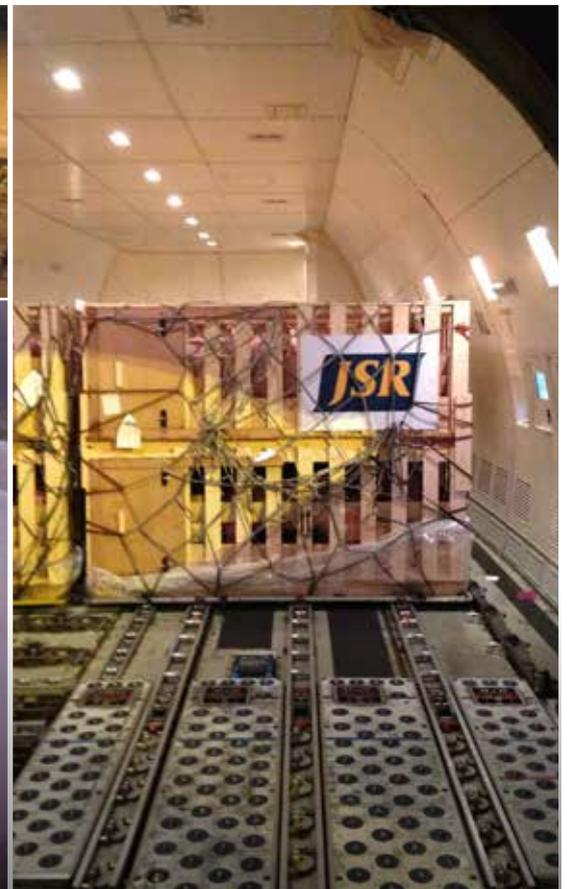
Unique boar preparation process

The unique Klasse Ai CleanFlow boar preparation process combines with IMV automated Collectis systems to maintain cleanliness and provide a high quality semen package. Every fully traceable ejaculate is thoroughly evaluated using advanced Computer Assisted Semen Analysis (CASA) for morphological abnormalities, viability, motility and density before release. The use of a high quality, long life extender is vital for the maintenance of semen quality. Retained samples from each boar continue to be examined for at least six days after collection.

Klasse Ai studs are independently monitored to ensure best practice is maintained and that semen is being processed consistently to maximise fertility and ensure traceability. Most Klasse Ai studs are EU licensed and are all monitored under the AHDB AI Standard. This standard is based on best practice principles and covers more than 70 individual standards, with internal and independent auditing performed annually.



Pigs



JSR Genetics

Pigs might fly... to Japan

British agriculture and specifically its breeding animals are highly regarded around the globe. The names used internationally for many livestock breeds have their origins in regions of the UK. In pigs, most commercial sows are a cross between the two breeds, Landrace and Large White. Helpfully for one UK-based company, the Large White is more commonly known throughout the world as the Yorkshire breed.

Pig breeding company JSR Genetics is based in the Yorkshire town of Driffield. JSR Genetics has been working with a Japanese business since acquiring the Cotswold Pig Development Company in 2002. Piqua Genetics in Japan was previously known as Cotswold Japan, another example of the overseas business utilising the imagery created from the British names.

However, the relationship between the two businesses has been built around much more than British place names and an image of the English countryside. Whilst fish remains the number one protein source in Japan, pork consumption per capita is at an all-time high: in excess of 15kg per person per annum.

The biggest competition faced by local producers in meeting this increased demand comes from product imported from Europe and North America. To be competitive, the local sow therefore needed to be highly productive and cost effective.

Advanced Japanese nucleus populations

Over the last decade, JSR Genetics has established new Japanese nucleus populations of Landrace and Large White pigs by flying live animals from the UK to Japan to ensure close links with the most genetically advanced lines available in its business. These lines allow Piqua Genetics to produce the commercial parent sow within Japan.

The business relationship goes beyond a simple transactional sale of livestock. These nucleus populations

need to be maintained and in order to do so, JSR Genetics has established database systems for Piqua Genetics to record their performance and evaluate their herds alongside the other JSR nucleus herds around the world. This enables them to keep pace with genetic development and avoids the need to go constantly through the logistically challenging process of importing and isolating new animals.

Whilst the performance of the pigs can keep pace with the best in the world, it is vital that the Piqua Genetics team also stay up-to-date with developments. Here, JSR Genetics can host visits to the UK to allow the Piqua management to see the research programme. Showcasing UK research at our leading universities and colleges is a valuable tool in the relationship. The most recent visit included a trip to see the in vitro production of embryos at the University of Kent. This took place at a specially developed laboratory in Canterbury, one of very few facilities in the world which are able to undertake this process with porcine material.

Exceeding expectations

The work cumulated in a product launch for Piqua Genetics in 2017 which introduced a new sow for their market. This was supported by presentations from the technical support team from JSR Genetics. The product launch was a success and the business now plans to expand production to meet demand. JSR Genetics has also assisted with the product's utilisation in the market by hosting, in November 2018, a technical visit of Piqua customers, eager to know more about the specifics of feeding, management and expected performance of the new product which is far exceeding the levels of output previously experienced on their farms.

The long-term relationship between JSR Genetics and Piqua Genetics combines good products and access to technology with a high level of technical support, both practical and academic. This continues to ensure that British pig genetics plays a valuable role in the supply of Japan's pork.



Deerpark Pedigree Pigs

Family-run UK business ramps up export trade

Family-run business, Deerpark Pedigree Pigs, is taking a growing proportion of the world's export markets which increasingly appreciate the quality of UK genetics.

Countries as diverse as China, India, the USA, Canada, Kenya, Nigeria, the Philippines, Thailand, Malaysia, Barbados, Ukraine, Nepal and St Helena all count themselves amongst Deerpark's customers.

Orders from some of these countries are growing so rapidly that exports from this Northern Irish company have increased from five per cent of its sales five years ago to around 40% today.

Brothers, Robert and Nigel Overend, who run the business, believe there is a range of reasons for the rapid growth which has developed after years spent forging personal relationships around the world.

"Our customers have seen that we are an established, family business and that we are in this for the long term," says Nigel (pictured right). "They like the personal touch and they also like the fact that we give training and support on site which helps them get the best results and performance from our genetics."

Technical success

The company's technical success with frozen semen has also been a big draw.

"It's particularly gratifying when we see technicians we have trained achieving conception rates which are far beyond anything they have had from any other country before," says Robert (pictured above with Nigel and his son, Joshua).

In fact, the stud at Deerpark has been perfecting the process of freezing boar semen over two generations of the Overend family and today, some of the top-performing herds supplied by the company achieve conception rates of 100 per cent with Deerpark boars.

Such has been the success of the Overends' business that both the British Pig Association and Rare Breeds Survival

Trust have designated the stud as the centre for their pig conservation programmes. Today, Deerpark is the semen storage facility for rare and minority UK native breeds such as the British Lop, Gloucestershire Old Spot, Middle White and Oxford Sandy and Black alongside the commercially important Large White and British Landrace.

Commenting on orders to China, Nigel, who regularly returns to the country with follow-up support, says: "Orders from China started in a small way so the customer could test the water. When they were confident in the performance, they moved on to larger, more regular orders.

"It is gratifying to see that these and other customers are keen to follow technical advice and adhere to breeding programmes to improve their own genetics.

"It is still the case that the UK is regarded as a leader in genetic improvement," he says. "The name of UK genetics is respected wherever you go, in any livestock species."



A semen shipment is prepared for export to China.

INTRODUCTION

UK poultry genetics and services dominate globally

Producing and processing healthy foods based on poultry is a major business in the UK. The industry is also a significant exporter of poultry products, supply materials and services to the rest of the world.

Latest figures show a national inventory of almost 182 million birds for commercial poultry production. Among the meat types these include about 118 million chickens and 11.25 million others such as turkeys, ducks and geese. In addition, surveys indicate about 53 million birds for egg production or as breeding stock.

UK egg producers market over 11 billion eggs per year for human consumption. Breeding flocks add another 1.5 billion eggs annually for hatching. The yearly production of table eggs has a current total value of about UK£625 million. Exports of hatching eggs add another UK£70 million per year.

Of the 1.8 million tonnes of poultry meat produced annually in the UK, UK chicken accounts for over 85% with the total production currently worth approximately UK£2.45 billion. Around 350,000 tonnes of fresh meat and products are exported each year.

As might be expected for a national industry with annual production of some 1.1 billion meat chickens, 15 million

ducks and geese and 14 million turkeys, the UK's poultry sector includes modern and highly developed sources of the hatching eggs and genetics needed to sustain its development. They play an important role in the export market, gaining from the UK's excellent standards of avian health. The UK is therefore a potent contributor of genetics to the poultry businesses of other countries.

A major advantage to exporters is that, after the World Organisation for Animal Health (OIE) proposed the so-called 'compartment principle' as a means of enabling international trade to continue without the risk of spreading disease, the UK became the first country to apply the idea to poultry breeding enterprises.

The OIE's code defines a compartment as an animal sub-population operated under a common biosecurity management system; it must have a distinct health status regarding specific diseases and must apply surveillance, control and biosecurity measures against these for the purpose of international trade. In the European Union, compartmentalisation is aimed specifically at the diseases Avian Influenza (AI) and Newcastle Disease (ND).

The UK compartment scheme for breeding poultry is an official project run by the UK Government's Department for Environment, Food and Rural Affairs (DEFRA) and members of the scheme must be inspected and monitored by Government veterinary officials. A number of importing countries have agreed that UK compartments provide sufficient reassurance that approved companies are free from AI or ND, although it is important to emphasise that the UK normally exports breeding poultry on the basis of national freedom from both AI and ND according to OIE criteria.

Poultry feed industry

Across the UK, the compound feed industry manufactures about 13.5 million tonnes of feeds per year for all farm animal species, of which about five million tonnes are produced for poultry. This includes numerous examples of speciality diets and other complete poultry feeds and supplements which are marketed globally. A number of major companies are involved

Global Poultry Primary Breeders

Chicken



Egg type
Hy-Line Intl
Lohmann

Meat Type
Aviagen,
Cobb

40% of
global

~90% of
global

Duck (Peking)



Meat Type
Cherry Valley
Farms

60% of
global

Turkey



Meat Type
Aviagen
Turkeys

70% of
global

Production and export of genetic stock: GGPs, GPs and Parent Stock (PS)



with this, including, for example, one of the world's biggest providers of enzymes for use in poultry feeds. Another UK-based supplier of nutritional solutions leads the way in early-feeding starter diets for chicks.

Welfare and ethical production

Furthermore, the UK poultry industry can also claim to be a world leader in the vital areas of animal welfare, advanced husbandry and the use of the sustainable and ethical production methods increasingly demanded by consumers in all countries.

Today in the UK, a market share of around 48% is enjoyed by free-range producers, whose hens spend most of their productive life roaming outdoors rather than being confined inside a building. An almost identical share of the market is taken by enriched housing systems, similarly regarded as welfare-friendly.

While small by comparison, organic is a significant factor in the UK egg industry and organic poultry production generally continues to gain support from consumers. An estimated 3.2 million hens and chickens are being produced organically on UK farms, which approaches 2% of the total

commercial bird population and is growing year by year. Both products and know-how from the organic sector have won customers in other countries as the demand for organic or 'biological' foods increases internationally.

Sustainability in poultry production is another area in which the UK has emerged as a centre of excellence. The same national animal-friendly mentality which has embraced high bird welfare standards over many years also recognises the benefits of antibiotic-free production methods and a meticulous attention to conserving resources of water and energy.

All of this is allied to an experienced and enlightened international outlook which sees a number of British companies involved in poultry markets internationally. For example, the largest free-range egg producer in the UK has extended its brand to the USA while the company which provides one-third of all poultry meat products to UK households also operates broiler sites in the Netherlands and Poland. Typifying such forward-thinking attitudes is another large UK food group, which is about to build what is said will be the most advanced poultry processing plant in Europe.



Poultry

Hy-Line produces and sells breeding stock for both brown and white egg laying hens to more than 120 countries world-wide. Its layers account for over 50% of the total laying hen population in the top 10 global markets. In the USA they have a market share of more than 70% and in China their share is over 60%.

Hy-Line UK Ltd leads the way in the production and distribution of day-old chicks to egg producers across the UK. It is also the second-largest distribution hub of Hy-Line International. Based in Warwickshire, Hy-Line UK delivers the latest Hy-Line genetics to more than 40 countries across the globe.

Hy-Line UK serves the world with high quality chicks from its cutting-edge Millennium Hatchery located near Birmingham in England's Midlands. Opened in 2000, the Millennium Hatchery is at the forefront of modern hatchery technology and is currently the largest commercial hatchery in Europe.

It achieved this distinction when an extension project was completed in 2017. This included extending hatcher room facilities by adding eight VidaTech hatchers from British hatchery supplier, Emtech. Further phases involved sourcing

PrimoTech single-stage setters, controls, ventilation products and upgrades from the same company.

Continued investment in the most advanced equipment have meant that its breeds are claimed to have the lowest carbon footprint of any birds available.

Millennium Hatchery's high values are achieved through investment: in developing the operating team and breeder farm facilities as well as having state-of-the-art incubation equipment. Recently, it has also renewed its transport fleet with purpose-built chick vehicles.

In recent times, Hy-Line has taken significant steps to deliver superior genetics to the customer sooner. The breeding programme is also achieving faster genetic progress in all lines than has been seen before.

Hy-Line's team of geneticists is making the genetic engine more powerful and more efficient. In fact, the recent pure-line selections have documented a considerably higher response than achieved in previous years. Hy-Line has narrowed the scope of genetic traits they analyse and, ultimately, use to select the next pure line generations. The company's goal is to achieve increased egg numbers, persistency, shell strength, egg weight and feed efficiency, to produce layers which are productive yet balanced.



Cherry Valley

Ducks for major markets in Vietnam and China

Genetic stock from Cherry Valley Farms continues to be the choice for over 80% of the world Pekin duck market, reflecting its continued improvement in performance with every generation, along with good reproduction, health and livability.

The company's selection programmes are based on multi-strain pedigree breeding in elite lines. Estimated genetic gains made in growth rate and feed conversion in the pure lines are always 3-4 years ahead of commercial stock. The average genetic gain per year for growth rate is about 32g per bird to 42 days of age. For feed conversion it is an improvement of 0.036 per year.

Analysis of customers' data suggests that commercial operations realise about 72% of the annual improvement in growth and 65% of the annual improvement in feed conversion. The potential value of these genetic gains for an operation processing 10 million ducks per annum, based on normal European costs and returns, would be an improvement in the value of liveweight amounting to almost 320,000€ and a reduction in feed cost of almost 375,000€.

Vietnam

Cherry Valley is present wherever ducks are produced commercially. Vietnam is a major duck market in South-East Asia and has a long history and tradition of duck consumption. Its modern duck industry is developing at a very rapid speed and duck consumption will gradually increase to become a very important source of animal protein as the standard of living improves.

In 2018, Haid Cherry Valley was established near Ho Chi Minh City as a joint venture between Cherry Valley

Farms and Chinese feed company, Haid. The Haid group's core business is in animal feed production and the group currently operates three feed mills in Vietnam, with a total annual production of 500,000 tonnes.

Haid Cherry Valley has now successfully imported its first flock of grandparent and parent stock into Vietnam and parent stock produced locally are now becoming available for distribution to Vietnamese customers.

The local market size is estimated at around 80-100 million ducks a year. Haid Cherry Valley aims to win a significant market share by selling locally produced commercial day olds. The move secures the supply into the Vietnamese market, even in the event of an Avian Influenza (AI) outbreak in Europe.

China

Another important development for Cherry Valley is an expansion programme at its Shandong operation to meet an ever-increasing demand for quality duck breeding stock in China.

The Shandong site has four farms and is currently producing 10 million eggs annually. The new housing is constructed to a very high standard to ensure the highest level of biosecurity. It also features full evaporative cooling in the summer and natural gas heating in the winter and is home to the Cherry Valley selection programme in China.

Cherry Valley has recently celebrated 25 years of Chinese joint venture operations and 15 years of having a fully owned operation and genetic selection programme in China. Today, the Chinese population consumes almost as much duck meat as broiler chicken and China is home to more than 2.5 billion Cherry Valley ducks!



Aviagen

Broiler breeders with emphasis on welfare

With a history of over 60 years in broiler breeding, Aviagen can trace its roots close to Edinburgh in Scotland, where its research and product development centre is now based. Today, the company provides breeding stock directly from its UK-based farms and hatcheries to customers around the world. Day-old broiler grandparent and parent stock chicks under Aviagen's widely recognised brand names, Arbor Acres, Indian River and Ross, are destined for more than 100 countries.

In the UK, Aviagen achieves a sales turnover of approximately £150 million per year, over 80% of which comes from exports. About 40% of the company's annual turnover is derived from exports to European Union countries and 42% from outside the EU.

The breeding company leads its breed and product support development from its UK base to give customers benefits in productivity, health, welfare and sustainability. This forms an important part of a global distribution network for broiler breeders, with two full-scale breeding programmes on two continents. Its 260 production facilities and 27 commercial hatcheries around the world ensure a good and timely supply to any customer wherever they are located.

The company's product range includes traditional white feathered breeds, focused on best production for further processing and whole bird outlets, to slower growing and coloured breeds targeted to new and evolving markets. All are bred in a balanced way to give healthy, robust and productive animals while providing the birds with the highest-quality care and welfare standards available.

The emphasis on bird welfare is also seen in shipping arrangements and the company's export operation sends day-old chicks through one of the world's most extensive and welfare-compliant animal shipment networks. This features a range of company-developed standardised best practices, such as maintaining comfortable temperatures and airflow levels for birds at all stages of transit. In fact, Aviagen meets or exceeds international airline shipment standards for live chick transport.

Aviagen also offers speciality breeding stock aimed to give customers flexibility in their product choice and to meet specific market requirements. The Rowan Range of speciality birds, with variable colouring depending on

male choice, is available in certain regions and meets the needs of selected niche or emerging markets, including the slower-growing, free-range and organic segments. The Specialty Male portfolio is a line of males for customers looking for specific performance traits in their broiler breeding stock, including high breast meat yield, adaptability to environments where elevated temperatures prevail or live production attributes such as feed conversion ratio and hatch.

To support further progress, Aviagen invests in excess of 10% of its turnover into research and development. A particular focus is on continual innovation through technologies enabling more detailed measurements of key traits that are included in selection. Such developments include the use of transponder-based technology for measuring the feed and water intake of birds throughout their life, and Computer Tomography (CT) to study body composition and give benefits in both yield and health characteristics. Most recently, the introduction of genomic selection has enabled the identification of birds with particularly favourable genetic make-up, so increasing genetic progress across efficiency, health and welfare traits.

The benefits from this work reach beyond production parameters and into sustainability. Chicken production uses less land and fresh water than beef, and greenhouse gas emissions are naturally low. In fact, chicken has the lowest carbon dioxide (CO₂) impact of all meat-producing species, and production uses less water and primary energy such as electricity and gas.

Poultry breeding companies such as Aviagen are making considerable progress to minimise the environmental effect of production even further. Through improved efficiency, they can now produce birds which require less feed grain and water than ever before, sparing thousands of hectares of arable land around the globe every year.

Through the genetic progress realised by Aviagen's breeding programme, bird efficiencies are continually improved, along with health, livability and meat yield. Thus, fewer resources are required to produce more high-quality chicken meat. These innovations work together to shrink the environmental footprint of production and alleviate its impact on climate change. They also make a compelling argument for chicken as the best solution to offer future generations an affordable and sustainable source of quality nutrition.

INNOVATION IS

GREAT

BRITAIN & NORTHERN IRELAND

60 years ago, British researchers co-discovered the structure of DNA. Today they continue to make world-changing discoveries. Unlock your global business potential with UK innovation.

DNA (deoxyribonucleic acid) molecule

www.great.gov.uk



UK RESEARCH & INNOVATION



Centre for Innovation
Excellence in Livestock

A single point of access to UK research capability

CIEL (Centre for Innovation Excellence in Livestock) is the UK Government's livestock innovation agency, helping to introduce new pioneering technologies into UK livestock production and world-wide.

The agency acts as the broker for one of Europe's largest livestock science hubs, working with world-leading researchers and industry partners across the supply chain – from farmers to processors, retailers, vets and feed companies – to identify challenges, potential solutions and routes to research and development (R&D) funding. To date, this CIEL-led alliance, supported by Innovate UK, has invested close to £70 million in new livestock R&D capability across all species.

Examples of current activity include:

Addressing production efficiency challenges

Optimising grassland productivity is a key driver of profitability on dairy, beef and sheep farms. Improving pasture utilisation by one tonne per hectare is worth an additional profit of £204 and £334 per hectare per year to beef and dairy farms respectively.

CIEL is managing a research-industry collaboration, working alongside 50 farms across England, Scotland and Wales in a new grassland improvement initiative called GrassCheckGB. Data on grass growth and quality collected from the farm network will enable predictions of future growth. Findings are published weekly and freely available, delivering a simple decision support tool to help farmers plan ahead and encourage uptake of innovative grassland management practices.

Positively impacting animal and human health

The UK is home to a wide variety of innovative medical technologies that can also be applied to agriculture. CIEL has supported Biotangents, a diagnostic company using



Developing a pen-side test to rapidly diagnose contagious pleuropneumonia in cattle and goats.

synthetic biology for ultra-low-cost testing, apply their technology in Africa to help pastoralists rapidly diagnose contagious pleuropneumonia (CBPP and CCPP). CBPP and CCPP are highly infectious diseases of cattle and goats and when left unchecked, can cause animal mortality. This, in turn, can have a significant impact on the livelihoods, health and nutrition of pastoral communities across Africa.

Similarly, CIEL is helping to combat antimicrobial resistance in livestock populations through application of a novel alternative to antibiotics developed by Gama Healthcare – a UK company developing infection control products for human healthcare markets. Gama are engineering bacteriocidal nanoparticles to combat enteric pathogens for poultry, including campylobacter which studies show is becoming increasingly resistant to conventional antibiotics. The resulting products will be trialled in China where antibiotic consumption for livestock remains high.

Understanding livestock genotypes

CIEL is supporting the UK's position as a world leader in animal genetics through financial support of EGENES (see page 41), a data platform for routine evaluation of livestock genotypes hosted in Edinburgh. The system provides key decision support for breeding programmes and has been adopted by major genetic suppliers across Europe and North America.

Over 50 companies have already joined CIEL for unparalleled access to both scientific and commercialisation expertise and as a platform for the dissemination of ideas. Since launching in 2015, CIEL, working alongside the Department for International Trade (DIT), the Foreign and Commonwealth Office (FCO) and the Science and Innovation Network (SIN), has become the single point of contact for international companies wanting to access UK research capability, as well as helping businesses find routes to market into the UK and Europe.



Roslin

Commercial arm of Roslin spreads technology world-wide

The Roslin Institute is famed for the creation of Dolly the sheep, the first mammal to be cloned from an adult cell. When she was born in 1996, she proved that specialised cells could be used to create an exact copy of the animals from which they came. Since that day, the cloning industry has blossomed and today, there is even one company in China reportedly producing 100,000 cloned cattle every year.

An important part of commercialising the processes developed at the Institute has been the advent of Roslin Technologies. This company was established expressly to find routes to market for the technologies developed at the University of Edinburgh's Roslin Institute, Royal (Dick) School of Veterinary Studies, and through collaborations with other university departments. In 2017, Roslin Technologies was the largest UK agri-tech start-up innovating on-farm products.

So, what has Roslin Technologies achieved since its conception?

"Our first year was geared around establishing the infrastructure, understanding and identifying the projects to commercially develop," says Glen Illing, CEO of Roslin Technologies. "Initially, we selected four projects and

worked with the principal investigators to transform them out of the lab and into an industrial process."

One of the technologies selected, coined Frozen Aviary, is the brainchild of researcher Dr Mike McGrew. This involves the harvesting of primordial (or stem) cells from poultry or other birds, enabling genetic development to be arrested and cryopreserved.

The technique lends itself to commercial breeding companies working with valuable genetic lines and conservation organisations working to prevent species extinction. The preserved stem cells can be used to faithfully breed animals with the exact genetic make-up of the animals from which they were harvested. Laboratories were established in 2017 and the service successfully launched, attracting clients of global significance.

In 2017 Roslin Technologies



Scotland's First Minister, Nicola Sturgeon (right), visits Roslin Technologies.



also acquired Ark Genomics Ltd, offering genotyping and gene sequencing services. Roslin Technologies has since expanded the services offered into genetic evaluations and is working with some of the world's leading genetic breeding companies. Last year Roslin Technologies became the genetic partner – providing genetic evaluations, genotyping and genomics services – to Danish Genetics, one of the largest pig breeding companies in the world.

Another technology harnessed by Roslin Technologies focuses on the production of specific proteins in chicken eggs which are not normally expressed. These proteins are in high demand in the pharmaceutical and research industries. Developed by Roslin Institute principal investigator Prof Helen Sang, her lead researcher, Dr Lissa Herron, joined Roslin Technologies to establish Eggcellent Proteins, to commercialise the technology. A flock of transgenic chickens was established and eggs containing the valuable proteins have been in production for the past year. Distributors have been organised in Europe and Asia, with sales commencing in 2019.

Other technologies in the pipeline include the production of animal cell-lines, which are grown in test tubes from biopsies, regressed to an embryonic state and induced to become any cell of the body. The cell lines are used for clinical trials, drug discovery, exploring the genome and for gene editing activities.

The project was spawned from human stem cell research and the technology developed for agricultural applications by Dr Joe Mee within Roslin Technologies laboratories. The cell lines of several species have been stabilised, ready to be offered for sale

along with associated services in 2019.

"We are always on the lookout for technologies we can take from the research environment to the market," says Mr Illing. "We have an excellent global industry network and a global mindset to commercialise genetic technologies world-wide."

The company continues to identify more technologies within the Roslin Institute while also looking at fledging companies or technologies developed in other universities, institutes or organisations.

There is a particular interest in harnessing more of the gene editing technologies for which Roslin is renowned.

"We are looking at ways to industrialise the process of identifying gene edit targets and getting the benefits out to industry," says Mr Illing. "This could enable producers to reduce or eliminate antibiotic usage, mitigate the impact of disease and increase economic production.

"In order to do this we need to not only validate that animals are indeed resistant to the certain diseases but also ensure they are otherwise unchanged, and safe to enter the food chain," he says.

The Institute has already developed research animals resistant to globally devastating diseases such as Porcine Reproductive and Respiratory Syndrome (PRRS), African Swine Fever (ASF) and poultry diseases such as Avian Influenza.

"It is clear the UK is leading the research and a lot of that is centred at the Roslin Institute," he says. "Whether it takes time to bring these technologies and products to market in the UK or Europe, or whether other countries will adopt them earlier, we will be ready!"



Glen Illing, CEO of Roslin Technologies with Dolly the sheep.



The Roslin Innovation Centre houses Roslin Technologies' offices and laboratories.



Langhill

The world's longest running trial in dairy genetics

Almost 40 years ago, Scotland's Rural College (SRUC) and Edinburgh University set up what has become the world's longest running selection experiment in dairy cows. Initially designed simply to demonstrate the outcome of genetic selection using artificial insemination, the experiment has since moved on to show what improvement is attainable and worth under different management systems.

Sited at SRUC Crichton Royal Farm at Dumfries Scotland, the two lines of cows were selected to have either the highest genetic merit (select) or national average (control) for production. Each line of cows was kept in two different management groups and fed either high or low calorie feed. These four groups continue to be extensively recorded for a wide range of traits including the number of inseminations per conception, disease, fertility, health, lameness, locomotion, behaviour and metabolic conditions.

Very specifically, all the cows in the four groups have their daily feed intake recorded throughout their entire lives. They are milked three times a day and have their liveweights recorded at each milking. Body condition and locomotion is scored weekly.

As well as milk production, a wide range of phenotypes are farmed at Langhill and are arguably the most important and valuable thing the cows produce. 'Phenotype farms' such as Langhill may be a source of difficult-to-measure traits in the future, providing information which can be used in the calculation of young sires' genomic indexes, which are increasingly important to UK farmers.

One of the projects currently under way at Langhill is investigating the genetics of feed intake. All cows in the herd are genotyped, so the relationship between their DNA and feed intake can be ascertained. This produces a 'SNP key' which can be used by all other farmers to obtain

predictions of feed intake for their cows using only their DNA. This work is being undertaken in collaboration with other research herds around the world and is expected to produce genomic breeding values for feed intake by the end of 2019.

In addition to this work, the milk mid infra-red (MIR) spectral data collected through the routine milk recording of Langhill cows has allowed prediction equations for feed intake to be calculated. These equations could be used across the entire national dairy herd, thereby producing millions of records for predicted feed intake. These records can be used in national genetic evaluations for feed intake, which are expected to be published for females after the sire evaluations have been published.

All of the cows at Langhill are also type classified and weighed. This allows prediction equations to be calculated for liveweight from linear type records. These are applied to all cows classified nationally and their predicted liveweights are used to produce breeding values for sires. The UK has a negative weight on liveweight in its main national efficiency index (Profitable Lifetime Index, £PLI), which encourages farmers to select high producing, healthy cows which are not continuing to increase in size so are therefore more efficient.

The Langhill lines of dairy cows contribute to national genetic improvement:

- **By providing the basis of the maintenance index**
- **As the sole UK source of feed intake records in the SNP key used for genomic predictions**
- **As the reference population of cows used to produce prediction equations from milk mid infra-red spectral data**

EGENES

The UK's genetic evaluation unit

Edinburgh Genetic Evaluation Services (EGENES) is the UK unit which undertakes genetic evaluation of UK farmed livestock. For dairy cattle, records are assimilated from all the national milk recording agencies, merged and validated in order to produce genetic evaluations. These are passed electronically to AHDB Dairy for subsequent publication to the industry. Currently, the unit evaluates over 18 million animals using over 200 million test day records with 58 million animals in the complete pedigree.

For both beef and dairy cattle, carcase data is assimilated from most UK abattoirs in order to produce carcase trait evaluations. This enables farmers to select sires whose offspring will have superior carcase characteristics. This is also important to dairy farmers since around half of all UK beef comes from the dairy herd.

At present, EGENES performs around 200 separate genetic and genomic evaluations every month. Around 3,000 new genotypes are received by the unit each month and the current inventory is over 300,000 genotypes.

New developments being considered are mostly around the methods used for genomic evaluations and the computing required to undertake them in a timely manner. These include across-breed and single step GBLUP (genomic Best Linear Unbiased Prediction) evaluations. Techniques including Deep Learning (a subset of Machine Learning) are being applied to predictions of disease from milk mid infra-red spectral data collected routinely at milk recording. Bovine Tuberculosis (bTB) is the current target of these techniques, which will be extended to Johnes Disease and Bovine Viral Diarrhoea (BVD) in time. EGENES is using an NVIDIA Graphics Processing Unit (GPU) powered desktop supercomputer to undertake these Deep Learning analyses using the Google software TensorFlow. This technology will help improve the reliability of genomic indexes for disease resistance and expand the range of diseases for which genomic indexes can be calculated. It also allows faster processing of ever-increasing datasets which means answers can be back in farmers' hands more rapidly, allowing more timely decisions to be made.



Agri-EPI Centre

Connecting farmers with research and innovation

Agri-EPI Centre serves to act as a connector between farmers, researchers and technology and engineering companies to help ensure new technologies, techniques, opportunities and ideas can be shared across all partners.

Agri-EPI Centre is one of the four Agri-Tech Centres of Agricultural Innovation, a unique collaboration between UK Government, academia and industry to drive greater efficiency, resilience and wealth across the agri-food sector. A £90 million investment from the UK's strategic innovation agency, Innovate UK, led to the establishment of the four centres in 2015 to enable them to harness leading UK research and expertise as well as build new infrastructure and innovation.

Since its foundation, Agri-EPI Centre has accelerated the adoption of precision agriculture and engineering technologies to boost productivity across the whole agri-food chain.

It is doing this by exploring how to optimise the performance of the often highly complex agricultural production and processing systems. This includes

considering key drivers of profitability and sustainability, such as livestock and plant growth rates, nutrient efficiency, product quality, and health and welfare.

The Centre provides world-class research and development facilities, connects academia and industry and progresses 'next generation' technologies such as sensing, imaging and robotics.

Since it was formed, Agri-EPI Centre has developed four agri-tech innovation hubs (Southern Hub at Cranfield; Midlands Hub in Newport, Shropshire; Northern Hub in Edinburgh and the South West Dairy Development Centre in Somerset).

Agri-EPI has a network of more than 120 members, which includes a number of farm businesses and organisations, and 28 'satellite' farms. The farms are set up as test-beds for research and development (R&D), to help improve productivity and efficiency within the farm and across the sector. The network measures key elements within each farming system using cutting edge agriculture techniques and equipment, such as robotics, sensors, satellite imagery, soil analysis and precision feeding and nutrient application.



Left: The Tailtech project monitors the posture of pigs to predict tail biting episodes.

The results of studies on each farm will be used in three ways:

- To test new products before they're taken to market
- To collect data with a view to identifying trends
- To demonstrate successful innovations to the industry

Example livestock projects

5G RuralFirst: Agri-EPI is the leading partner in the smart farming element of this Cisco-led initiative to ensure rural areas are amongst the first to benefit from the advent of 5G mobile technology. The trial will help provide significant opportunities to transform UK agriculture into a smart, high-tech industry, through innovations in sensors and remote diagnostics, data collection, drones, wider precision farming techniques and autonomous vehicles.

Beef monitors: One of Agri-EPI's satellite farms is at the forefront of trialling new Beef Monitor crates developed by Ritchie Agricultural in conjunction with Agri-EPI. Cattle voluntarily enter the crates – which each have an integrated water trough – where inbuilt sensors record liveweight (and in future, other data). With the correct

analysis, this daily data can be hugely beneficial in helping a farmer make speedy decisions to reduce costs and ensure animals are delivered to the abattoir in-spec.

Tailtech: Tail biting in growing pigs is affected by many risk factors, but an outbreak can start without warning or obvious cause. Although tail-docking can play a part in alleviating the problem, it is banned as a routine practice in the EU. Addressing this economic and welfare issue, the Tailtech project is developing an innovative new solution which begins with the observation that pigs adopt a different tail posture before an outbreak. The project involves a multi-disciplinary approach including agri-tech engineers, animal scientists, veterinarians and pork supply chain partners.

Milkalyser: This integrated, sensor-based technology is the first to provide inline testing of milk progesterone, opening the way for the most reliable method of heat detection to be automated on farm. Milkalyser is mapping the progesterone profile for each cow in one of the first trials to take place with the 180-strong herd at Agri-EPI's South West Dairy Centre. The centre opened in October 2018 and is focused on providing a truly innovative environment for the development, testing and demonstration of new technologies and techniques to support sustainable, efficient and high health and welfare milk production.



AHDB

The Agriculture and Horticulture Development Board is a statutory levy board, funded by UK farmers, growers and others within the supply chain. Its purpose is to inspire the UK industry to succeed in a rapidly changing world and equip businesses with easy-to-use, practical know-how which they can apply straight away to make better decisions and improve performance. AHDB is a leading funder of applied agricultural and horticultural research and knowledge exchange in the UK. Other major work programmes include export market access and development, UK advertising and promotion campaigns, and market pricing and analysis.

The technical research and knowledge exchange work is focused under six outcome-based themes. One of those is 'realising genetic potential', which looks at areas such as the genetic basis of resistance and resilience to animal and plant pests and diseases, as well as coordinating activity in animal breeding research and evaluation. The export work has two main elements, firstly working with governments around the world to secure necessary technical certifications for market access; secondly attending global food trade shows to provide a platform for British exporters to meet potential clients, foster existing relationships and showcase British produce. AHDB supports meat and livestock in England; horticulture, milk and potatoes in Britain; and cereals and oilseeds in the UK covering 72% of UK agricultural output.

AHDB also works closely with other levy boards on exports: LMC in Northern Ireland, QMS in Scotland and HCC in Wales.

www.ahdb.org.uk
www.hccmpw.org.uk
www.qmscotland.co.uk
www.lmcni.com



BPA

The British Pig Association established in 1884 is non profit membership organisation for pig breeders. The Association works with government to represent the interest of pig breeders and pig breeding companies. Its mission is to develop national and international breed improvement and conservation programmes.
www.britishpigs.org.uk



British Poultry Council

As the voice of the British poultry meat sector and the trade association for producers of poultry meat from chickens, turkeys, ducks and geese, the Council addresses issues on all parts of the production chain: breeding, hatching, growing, and processing.
www.britishpoultry.org.uk



NBA

The National Beef Association is a member-led charity whose mission is to continually promote and support the UK beef industry at all levels. It does this by engaging with the Government and Devolved Administrations to promote and develop the interests of British beef farmers.
www.nationalbeefassociation.com



NPA

The National Pig Association is the representative trade association for British commercial pig producers and allied industry members. It is affiliated to the National Farmers Union (NFU) and represents the interests of NFU members that produce pigs.
www.npa-uk.org.uk



National Sheep Association

NSA

National Sheep Association is an organisation that represents the views and interests of sheep producers throughout the UK. It is funded by its membership of sheep farmers and its activities involve it in every aspect of the sheep industry.
www.nationalsheep.org.uk



RABDF

The Royal Association of British Dairy Farmers is a UK charity focused on the unique needs of milk producers. It is a national dairy membership association with unique relationships up and down the whole supply chain and focuses on influencing and lobbying, developing young talent, improving business resilience, and identifying and showcasing ground-breaking innovation.
www.rabdf.co.uk



UKTAG

UK Technology for Agriculture & Genetics is an accredited partner with the UK Department for International Trade. Its mission is to help UK companies develop exports and assist overseas companies to find suitable business partners and opportunities in the UK.
www.uktag.co.uk



Cattle

AI Services NI

AI Services (Northern Ireland) supplies an efficient and effective artificial insemination service to livestock producers throughout Northern Ireland. All semen collected in the company's EU-approved stud is eligible for export to the EU and further tests can be carried out to allow for semen to be exported world-wide. www.ai-services.co.uk

Cogent

Cogent operates the UK's largest bull stud and has successfully developed a breeding programme founded on production, type, and reliability. Cogent was the pioneer of sexed semen technology and continues its work today to improve the process, research and development of new technologies, which will aid the modern farming business. www.cogentuk.com

Genus

Genus Breeding is part of the world's leading provider of bovine genetics and reproduction services, marketing in more than 70 countries. Alongside this is its technologically advanced range of forage, nutrition, foot and udder care products. Through Genus's extensive research and development programme, its cutting edge technology is being used to maximise the potential of beef and dairy farms world-wide. Genus Breeding is part of ABS Global, a division of Genus plc. www.genusbreeding.co.uk

UK Sire Services Ltd

UK Sire Services, the south Devon-based company founded in 2001, is the largest fully independent EU-licensed bull stud and semen store in the UK. The company possesses the flexibility to access bulls of all breeds resident in the UK and has exported semen from over 40 breeds all over the world. www.uksiresdirect.com

Sheep

AB Europe

Animal Breeding Europe (AB Europe) is the leading supplier of artificial breeding services to the UK livestock industry. A young, dynamic and innovative company, it is constantly striving to develop new technologies in order to benefit the UK artificial breeding market as a whole. www.abreeds.co.uk

Farmgene

Farmgene provides embryo transfer, artificial insemination (AI) and semen freezing services to the British sheep farmer. Services are provided both on farm and from the company's AI centre at Ensdon House, Montford Bridge, Shrewsbury. The AI centre is licensed to export semen and embryos. www.framgene.com

Pigs

Deerpark Pedigree Pigs

Deerpark Pedigree Pigs is a family-owned business which guarantees personal attention. Now experts in freezing and thawing boar semen, its product range comprises breeding pigs, artificial insemination and technical support services. www.deerpark-pigs.com

JSR Genetics Ltd

JSR Genetics has established a global brand for profitable pig production with an unparalleled range of top quality breeding stock and semen with an exemplary health scheme, which assures customers of total bio-security. The company aims to breed pigs which perform profitably for the producer and create pork which is of exceptional eating quality for the consumer. Its commitment to improving meat quality ensures its pigs are fit for farm and fit for fork. www.jsr.co.uk

PIC UK Ltd

PIC is the international leader in the provision of continuous genetic improvement in pig breeding stock and in world-class technical support to the global pork supply chain. The company combines quantitative analytics with leading-edge biotechnology to develop breeding stock which helps its customers maximise profitability. Product range: breeding pigs, AI, technical support services. <http://gb.picgenus.com>

Rattlerow Farms

Rattlerow Farms is one of the largest and longest established, privately owned and entirely independent pig genetics businesses in Europe. Its artificial insemination division is Klasse Ai. From the Rattlerow EASY2MANAGE damline breeding stock to the wide range of sirelines supplied by Klasse Ai, it is well-placed to provide genetic solutions for any farming situation. www.rattlerow.co.uk

Poultry

Aviagen

Aviagen broiler breeders supply day-old grandparent and parent stock chicks to customers in more than 100 countries world-wide under the Arbor Acres, Indian Rivers and Ross brand names. eu.aviagen.com

Aviagen Turkeys

Aviagen Turkeys supplies turkey breeding stock from the world-renowned brands of B.U.T. and Nicholas. The B.U.T. and Nicholas brands are recognised around the globe as marks of quality and superior performance. Their extensive product portfolio provides Aviagen Turkeys' customers with choice from a range of market-leading products to suit their specific operations and requirements. www.aviagenturkeys.com

Cherry Valley

Cherry Valley Farms is the world's leading breeder of Pekin ducks, with more than 50 years' experience in the genetic improvement, breeding and production of Pekin ducks. Cherry Valley breeding stock is delivered to customers in more than 30 countries and is the breed of choice wherever Pekin ducks are farmed. www.cherryvalley.co.uk

Cobb UK Ltd

Cobb UK is a poultry research company engaged in the development, production, and sale of broiler breeding stock. The company serves its customers through the use of innovative research and technology to make protein healthy and affordable world-wide. www.cobb-vantress.com

Hy-Line UK

Hy-Line UK is a leading producer of day-old chicks to egg producers across the UK and Ireland. Its range includes the world-leading Hy-Line Brown. Pioneering research from its parent company, Hy-Line International, has led to the development of genetically advanced birds, with each new generation being bred for a longer, more productive life. www.hy-line.co.uk

Aberystwyth University

www.aber.ac.uk

Aberystwyth University has one of the leading agriculture departments in the UK. Its agricultural degrees include all aspects of agriculture and agricultural production systems and will provide students with the practical and theoretical understanding to develop a worthwhile career in agriculture or allied industries. Its courses include: teaching which provides both practical skills and a scientific knowledge base to underpin your future career; visits to farms and businesses that are industry leaders in innovation; the opportunity to use your learning and skills in applied exercises of direct relevance to your future careers; the opportunity to study through the medium of English or Welsh. Aberystwyth University is also a prominent hub for research across the agricultural sciences including in the field of livestock production science.

Edinburgh University

www.ed.ac.uk

The University of Edinburgh is one of the world's top universities, consistently ranked in the top 50 and placed 18th in the 2019 QS World University Rankings. It also ranks in the UK top 10 and in the world top 100 universities for employability of graduates and in the world's top 25 most international universities. Quantitative Genetics and Genome Analysis at the University of Edinburgh is a suite of full-time taught study programmes which lead to either a Masters (MSc) degree (12 months) or a Diploma (9 months). Within the QGGA suite, students elect to take specialist programmes in Animal Breeding and Genetics, Evolutionary Genetics or Human Complex Trait Genetics. Based in the internationally renowned Institute of Evolutionary Biology, this MSc draws from the wealth of expertise available there, as well as the teaching, research expertise and facilities of Scotland's Rural College, the University's Centre for Genomics and Experimental Medicine, the Medical Research Council's Human Genetics Unit and the Roslin Institute (birthplace of Dolly the sheep).

Harper Adams University

www.harper-adams.ac.uk

Harper Adams University delivers higher education and quality research for the delivery of a sustainable food chain and rural economy. The 2019 QS World University Subject Rankings placed the University first in the UK and second in the world for employer reputation. This indicator, based on survey responses from employers around the globe, clearly demonstrates the way in which the University works with industry to positive effect – from joint research projects to student industry placements and from knowledge exchange activities such as industry short courses to the scholarship support for our students generously provided by a large number of companies.

Newcastle University

www.ncl.ac.uk

Newcastle University is a vibrant Russell Group institution, undertaking world-changing research which enhances animal health and welfare, sustainability, and social acceptability. We work across pork, poultry and dairy. A key component of our work is the Centre for Digital Innovation Applied to Livestock (C-DIAL). Based at our Cockle Park Farm it develops and uses new technologies for precision livestock farming.

Nottingham University

www.nottingham.ac.uk

The University of Nottingham is a pioneering institution providing an exceptional research-led education for 45,000 students from over 150 countries. The focus in the Division of Animal Science School of Biosciences is on feed efficiency and product quality in livestock systems whilst minimising environmental impact. We research ruminant and non-ruminant nutrition, reproduction, meat and milk composition, animal behaviour and welfare, and environmental emissions. Facilities include the Centre for Dairy Science Innovation and the Centre for Large Animal Biology.

Royal Agricultural University

www.rau.ac.uk

The Royal Agricultural University (RAU) has been at the forefront of agricultural education and a key contributor to the land-based sector for more than 170 years. In 2019 the RAU became the first small, specialist University to be made a Centre of Excellence by the Institute of Enterprise and Entrepreneurs.

SRUC

www.sruc.ac.uk

The creation of Scotland's Rural College (SRUC) took place in 2012 by merging SAC (the Scottish Agricultural College) with three respected partners (Barony, Elmwood and Oatridge Colleges). SRUC delivers comprehensive skills, education and business support for Scotland's land-based industries, founded on world class and sector leading research, education and consultancy. The next generation of business leaders and policy makers will need to be highly skilled and knowledgeable to navigate their way through a complex operating environment. To achieve this, SRUC will support land-based communities and industries by drawing on its accomplished history of more than a century of success. Strong in its heritage, SRUC strives to lead the way in delivering economic, social and environmental benefits while providing a strong voice for our rural industries.

Queen's University Belfast

www.qub.ac.uk

Queen's University Belfast has strategic partnerships around the world, ranking 16th in the world for international outlook and in the top 25 of the world's most international universities (Times Higher Education World University Rankings). Our Food Safety and Biotechnology programme focuses on applied aspects of advanced and emerging analytical technologies to address current issues in food safety, nutrition and food supply, placing a strong emphasis on the link between improved food safety and nutrition and improved public health. Research strengths include animal food and feed safety, animal health and disease diagnostics, food safety detection methodology, global food security and food traceability and authenticity.

For a full list organisations/breed societies recognised by the UK government visit: <http://bit.ly/UKanimalbreeding>

For official statistics on UK farm animal genetic resources recognised by the UK government visit: <http://bit.ly/UKgeneticresource>



For more information about UK suppliers visit the UK TAG Directory: www.uktag.co.uk

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For more information about UK livestock and genetics,
please visit www.uktag.co.uk or contact:

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