afbi Agri-Food and Biosciences Institute

AFBI RESEARCH IMPACTS 2018

CONTENTS

FROM THE CHIEF EXECUTIVE

Advancing the local and global agri food sectors through scientific excellence

I am pleased to present the second in the series of **AFBI Research Impacts** in which we highlight some of the latest achievements from our research and scientific work undertaken within AFBI.

A recent report from the Agricultural and Horticultural Development Board entitled "Driving Productivity Growth Together" highlighted that the UK, including Northern Ireland, has some of the most productive and dynamic farming businesses in the world.

However, the report also indicated that over the last number of years the rate of productivity growth in the UK agri-food sector has been lower than a number of other countries, for example Germany, the Netherlands, France and the United States. The report indicated that the underlying reasons for the lower rate of productivity growth in the UK include under investment in applied research and a fragmented approach to research and knowledge exchange.

Against this background, AFBI has prioritised investment in applied research and works closely with farmers, processors and retailers across the agri-food and fisheries industries. This investment ensures that AFBI has excellent connectivity and interaction with farmers and the wider agri-food industry, and it is a two-way process – many farmers and industry pioneers have some of the best ideas for new technological advances.

The interaction between leading farmers, industry leads and applied researchers results in a real step change in productivity and efficiency and the research impacts profiled in this report provide excellent examples of AFBI's work with industry across a wide range of scientific disciplines – from soil to society and sustainable fisheries and farming.

AFBI also plays a crucial role in providing the evidence base for policy development by DAERA – this will be particularly important given the need for the UK and Northern Ireland to develop new innovative, locally focussed and evidence-based agricultural policies following the UK's exit from the European Union in 2019. I am pleased to acknowledge the excellence of our scientists and support staff within AFBI and also our wide range of national and international collaborators who have made an important contribution to the achievements presented in this report.

Finally, I wish to acknowledge the various funding bodies who have supported the work presented here. The Department of Agriculture, Environment and Rural Affairs is AFBI's primary funder through provision of grant-in-aid. However, since its creation in 2006, AFBI has grown its external funding year-on-year from £6m in 2006 to £23m in 2017. This is testament to the excellence of our scientists and the relevance and application of AFBI's ongoing research programme, with particular acknowledgment of support from AgriSearch, the European Union, Defra (GB), DAFM (ROI) and a wide range of commercial agri-food companies.

Dr Sinclair Mayne
Chief Executive

Unearthing our soil secrets

Northern Ireland's most comprehensive soil sampling & analysis project

In 2017 AFBI and DAERA launched a free Soil Sampling and Analysis Scheme for all Northern Ireland livestock farmers.

The driver was a lack of soil testing on grassland farms, and the need to improve phosphorus (P) use efficiency. The aim was to increase farm profitability, while meeting targets for water quality improvement. This was the largest and most intensive soil testing scheme ever carried out in Northern Ireland and possibly in the UK & Ireland.

The AFBI project had two components:

- An 'Open Scheme' for all livestock farmers across the entire province (applications from 520 farms - comprising 12,300 fields).
- A 'Catchment Scheme', targeted at farmers in 11 sub-catchments of Upper Bann (applications from 520 farms comprising 7,600 fields).

Participating farmers received detailed information about the nutrient status of their soils. This was supported with training by CAFRE. Farmers therefore will be able to optimise phosphorus (P) and potassium (K) management in line with crop requirements; accurately target applications of slurry and fertiliser nutrients; maximise crop yields and increase farm profitability by reducing costly fertiliser nutrients in fields already well supplied with P or K. In addition, they will reduce the negative impacts of excess P on water quality.

In addition to soil test results and nutrient recommendations, farmers in the Catchment Scheme will also receive maps indicating the risk of P loss from their farmland to water.

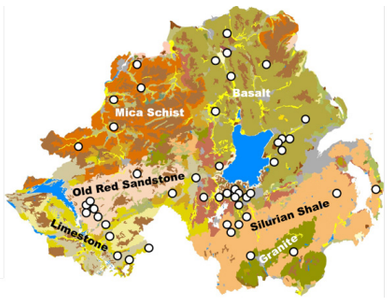
The Upper Bann river catchment has been a focus for AFBI research for over 20 years, with regular water quality monitoring at all 11 sub-catchments. The new data will make this catchment an invaluable research platform for identifying and testing strategies to reduce P loss to water. The scheme has provided a 'Proof of Concept Platform' to evaluate the feasibility, practicalities and farmer buy-in to soil testing, as advocated in the Sustainable Agricultural Land Management Strategy (SALMS).

Research Leads:
John Bailey, Rachel Cassidy and Alex Higgins

Funding:
Scheme Actions and Activities were funded from EU Exceptional Adjustment Aid (EAA), and Scheme Administration was funded by DAERA

Sulphur - the Cinderella nutrient

Remedying the chronic sulphur deficiency in Northern Ireland grassland



Map of Northern Ireland showing the main soil parent materials and locations of 49 farms where silage fields were S deficient at 1st cut.

Sulphur deficient silage swards: (a) moderately S deficient, and (b) acutely S deficient.

AFBI research has highlighted a dramatic decline in sulphur (S) availability in grassland crops in Northern Ireland since the mid-1960s.Sulphur balance results show that soil S reserves which built up between 1940 and 1960, as result of S-rich fertiliser, have been totally depleted.

Research Leads:
John Bailey and Crawford Jordan

Funding:
by the Department of Agriculture and Rural Development (DARD) in support of the VISION (V001) Project.

This reflects the changeover to zero-S and low-S fertilisers, combined with the mobilisation and loss of sulphate in drainage water.

Sulphur deficiency is now ubiquitous. Previous research during the 1980s indicated that S-deficiency was primarily a problem on light textured sandy soils. However, recent AFBI research has shown the problem is now widespread across all soil types, including heavier textured clays and clay loam soils.

In the past, S-deficiency was typically manifested in mid to late season and the advice was to apply S for second and third cut silage crops. Now deficiency is identified as a problem in first cut crops. Out of 300 silage fields surveyed on 67 dairy farms between 2004 and 2006, 38 per cent had silage swards which were S-deficient at first cut, compared to only 17 per cent at second cut.

While manures contain large quantities of S, AFBI research has shown it is largely unavailable to crops during the season of application. This makes applying S-containing fertiliser to grassland essential, even if organic manure is used. This eliminates the risk of significant yield losses as a result of S-deficiency. Up to 20% of dry matter can be lost without significant grassland symptoms being obvious. When symptoms do become noticeable, up to 40% of dry matter production may already have been lost. This represents losses of between £100 and £300/ha.

Whilst soil testing is essential to make informed decisions, AFBI's research has shown that winter soil test results are not a good indication of S-deficiency in spring. To eliminate this risk, S-containing fertiliser should be applied to all grass swards in spring. On heavy textured soils there will then be no need for further application that season. At £8/ha, the additional cost is significantly less than the possible loss of up to £300/ha. On light textured sandy soils further applications may be necessary to support second or third cut silage crops.

As a result of AFBI's work, inputs of fertiliser-S, which in 2000 had declined to less than 500 tonnes/year from double that output in the 1950s and 60s, have increased to 5000 tonnes/year. AFBI's advice is to routinely apply a S-containing fertiliser to silage swards in spring - proof of the positive impact of research.

Policy, the economy and Brexit

Development of Northern Ireland's food processing sector

AFBI is leading major programmes of research modelling policy impacts and market developments for Northern Ireland and the UK.

The Agricultural and Food Economics team in AFBI has developed a model that maps the economic linkages within the agri-food sector and with the wider regional economy. AFBI's model has shown that in Northern Ireland every job created in the food processing sector supports two jobs elsewhere in the economy.

AFBI economists have also provided evidence to DAERA for the development of an agri-food strategy for Northern Ireland. This research was aligned to the work of the Agri-Food Strategy Board (AFSB) and helped support its action plan, Going for Growth. In particular, AFBI's research contributed to recommendations on the marketing and branding of local food. The research is also part of the debate on future policy as we exit the EU.

Research Leads:
Ziping Wu and Erin Sherry

Funding:
DAERA

Brexit impacts on UK agriculture

The AFBI team's most recent work has focused on the potential impacts of Brexit, with work commissioned jointly by the four UK administrations to assess the likely impact for the UK as a whole and for each of the four UK administrations.

This research used the sophisticated FAPRI-UK economic modelling system to assess the potential impacts of three possible post-Brexit trade outcomes: a 'soft Brexit' and two 'hard Brexit' options.

These options were compared against a baseline where the UK remained fully integrated in the EU's single market. The results showed potentially major impacts from the two 'hard Brexit' options – World Trade Organisation default tariffs and trade liberalisation – particularly on livestock prices and production.

The research has provided an important evidence base for a wide spectrum of stakeholders from government to Farming Unions, to drive agricultural policy responses to the Brexit process.

Research Leads:
John Davis, Myles Patton and Siyi Feng

Funding:
Defra and devolved administrations

New insights into transition feeding of dairy cows

The period around calving is stressful. On top of the general trauma, the dairy cow faces an increased risk of infection and injury, social challenges from entering the milking herd, and a dramatic change in diet. A rapid increase in milk yield can also lead to 'energy deficiency' and metabolic diseases. However, good nutrition and management in the dry period prepares cows for high milk yields and fertility levels, while minimising the risk of infection.

Research Leads:
Mark Little and Conrad Ferris

Funding:
DAERA and AgriSearch

Feeding concentrates in the dry period is often recommended to improve body condition score before calving. It has also been suggested this will 'prepare the rumen' for high concentrate diets post calving. However, the actual benefits are unclear.

AFBI dairy scientists have examined the impact on cow performance of feeding concentrates during the dry period. One study was conducted on commercial farms over a two-year period, while detailed immune function trials were undertaken at Hillsborough.

These examined:

- The impact of concentrates over the entire dry period;
- Restricting concentrates to the last few weeks and;
- Feeding no concentrates at all.

Cows with a moderate or high condition score at drying off (2.75 or higher) had lower intakes post-calving. They lost more body condition in the dry period and during the first 12 weeks of lactation than those with a low (2.5 or less) condition score. While performance post-calving was unaffected by condition score at drying off, fertility of thinner cows was marginally improved.

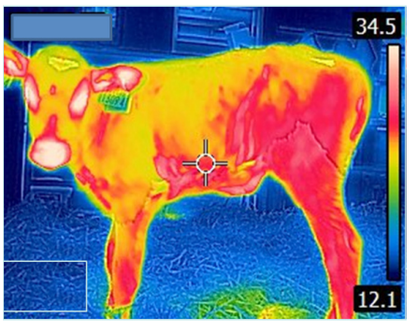
Cows offered no concentrates during the dry period lost slightly more body condition before calving. Offering concentrates had no effect on milk production, quality, fertility or somatic cell count during the next lactation. While immune function around calving was improved with concentrate feeding, this did not translate into better animal health.

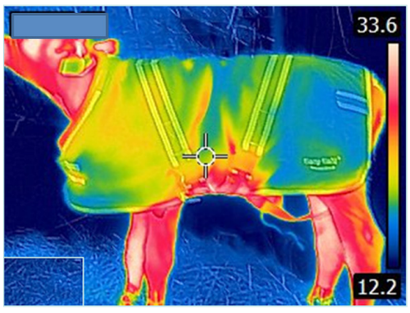
Around a third of cows that were culled during the trial were culled in the first 60 days of lactation. This highlights the challenges cows face. It is particularly relevant to thin cows (condition score of 2.25 or less) which were offered a forage only diet during the dry period, as they had a substantially higher risk of being culled in the 60 days post-calving.

These results support the recommendation of a target condition score of 2.75 at drying off for cows on high input systems. They confirm that it can be difficult to get dry cows to gain body condition, even if concentrates are offered throughout the dry period.

Very thin cows have an increased risk of being culled in early lactation, and so need a special management focus in late lactation and during the dry period.

Ensuring calves survive & thrive





Previous AFBI research has proven that ill-health in the early weeks of a calf's life contributes to reduced growth rates as it matures and leads to a delay in the age at first calving. It also increases rearing costs and reduces profitability.

Research Leads:
Steven Morrison and Ruth Kinkead

Funding:
DAERA and Agrisearch

Across the UK, calf mortality rates range from 8 to 15% in the rearing period, costing an estimated £140/heifer, with the main causes being enteric and respiratory infections.

In comparison, a recent AFBI study found average mortality rates across Northern Ireland farms were lower than in the UK as a whole, at 6%. Research has also shown a reduction in mortality is possible through proper colostrum management. Feeding the calf up to four litres of colostrum in the first hours of its life results in passive immunity, providing sufficient antibodies to protect it as well as the essential vitamins and minerals needed to aid ruminant development.

AFBI discovered that a key determining factor influencing calf mortality rates was the large variation in the nutritional quality of the colostrum, mainly caused by delayed collection and inadequate storage. This also led to reduced levels of immunoglobulins (IgG) and high bacterial counts.

Past research by AFBI has shown that higher levels of good quality colostrum lead to a reduction in morbidity and greater immunity transfer. Morbidity in dairy young-stock can have significant effects on the future performance of heifers in the milking herd.

As a result, AFBI is now investigating farm and animal factors that influence the concentration of ingredients in colostrum. AFBI scientists are also spearheading novel technologies that can detect early ill health to enable successful intervention. These include thermal imaging cameras, activity sensors and calf jackets as well as precision feeding systems that automatically detect reduced intake and growth rates.

Flock health first

Benefits of sheep health planning:

The importance of flock health and production planning (FHPP) is widely recognised across the sheep industry. In Northern Ireland, AFBI identified the need for a more co-ordinated approach that can improve financial returns through better health, welfare and improved performance. The goal is a targeted, but flexible FHPP in collaboration with farmers and their vets. AFBI's research programme is currently running on ten farms across Northern Ireland.

Research Leads:
Aurelie Aubry and Jason Barley

Funding:
DAERA

The programme is based around a number of key measures documented in a 20-page booklet which includes:

- Audit to establish the current health and performance of the flock, including barren and lambing rates, health/ disease status.
- Collation of routine treatmnts and health monitoring.
- Confirmation of quarantine procedures.
- Definition of three areas of intervention along with a list of actions.

The FHPP is updated every year to monitor progress.

The programme has confirmed that more flock data needs to be recorded, especially on the number and causes of losses/culls. Key intervention goals have been identified across all flocks ie tackling reproductive wastage; reducing growing lamb losses; and improving gut worm and fluke control. The most common actions across the 10 farms are:

- Trace element profiling of breeding ewes
- Regular faecal egg counts to decide parasite treatments
- Adjustments to vaccination and parasite control programmes
- Laboratory investigations of abortions and other lamb losses.

Benefits include improved fertility and lamb growth and cost savings from reductions in mortality and treatment costs.

A lowland farm with 400 ewes and 50 replacement ewes had lost 13 ewes to enzootic abortions in 2016. Following the introduction of the FHPP vaccination programme for replacement ewes, there were no abortions in 2017. Vaccine costs were £300 but the additional lamb output was worth more than £1500.

A hill farm with 200 ewes targeted lamb viability. The supplementation regime for twin and triplet bearing ewes was adjusted, along with parasite treatments in response to anthelmintic resistance. Lamb mortality was reduced, giving the farmer the income from an extra 22 lambs for the cost of some additional ewe feeding.

Trials confirm that plans need to be specific to individual farms and used to identify achievable targets. It is also crucial to record performance data, including animal losses, and make best use of benchmarking. The involvement of all stakeholders in the health planning process is vital.

The genetic merit

Improving the fertility of the Northern Ireland suckler herd

Through its work with industry, AFBI has recognised the need to improve both the fertility and genetic merit of the suckler herd. The estimated average calving interval for the Northern Ireland herd is 415 days – which is substantially higher than the target of 365 days.

Research shows that each additional day above the 365 day target costs £3.50. This is based on both the cow feeding cost and calf weight and equates to £175 a cow. This adds up to a huge annual cost for the local beef industry of £47 million.

An AFBI survey showed that producers who selected bulls based on visual assessments had calving intervals 15 days longer than those who based their selection on Estimated Breeding Values. This simple change when sourcing replacement bulls or AI sires could be worth £52.50 a cow.

The average size of the suckler herd in Northern Ireland is low at just 17 cows. This makes the affordability of regularly sourcing a new bull questionable. However, without the introduction of new genetics on a consistent basis, the ability to improve the genetic potential of the herd is limited.

One way to overcome this is through the use of Artificial Insemination (AI). AI involves heat detecting the herd twice daily for at least 30 minutes. This is highly labour intensive, but working with industry, AFBI has evaluated a range of synchronisation programmes for suckler farms which can be tailored to the needs of the farmer. Provided all procedures are followed according to the set protocol, conception rates of 55 to 65% are achievable to first service, with 80 to 90% to first and second service. The adoption of programmes like these within the suckler herd could dramatically improve herd fertility. AI also enables the use of superior sires which have the potential to fast track improvement in genetic merit of the suckler herd.

Research Leads:
Francis Lively

Funding:
DAERA, AgriSearch, Ai Services, Genus and Zoetis

Nutrition + management delivers results!

Research demonstrates sow and piglet potential

AFBI research has confirmed that sows can wean litter weights of over 115 kg over a 28 day lactation and that pigs with low birth weights can have feed efficiency ratios below 2.4 during the finishing period. In comparison, commercial litter outputs rarely exceed 105 kg and the average feed efficiency of finishing pigs in Northern Ireland is 2.7.

Research Leads:
Aimee Louise Craig and Elizabeth Magowan

Funding:
DAERA and Pig ReGen Ltd

The improved performance achieved at AFBI was driven by a combination of nutrition and management.

Increases in litter sizes mean piglet birth and wean weights have fallen over recent years. However, weaning weight is a critical factor in lifetime performance, creating a productivity conflict. AFBI's goal was to develop nutritional and managerial strategies to increase wean-weights and optimise the lifetime performance of low wean-weight piglets.

Studies investigated a range of energy and protein levels in the diet as well as different feed levels during lactation.

On the base (control) diet (13.6 MJ DE/kg; 1% total lysine, intake of 7.5kg/day) sows produced a litter weight of 101 kg over a 28 day lactation. The approach that produced the greatest weaning weight (115 kg) was when sows were offered a diet containing 15.8 DE MJ/kg and 1.3% total lysine at an intake of 7 kg/day. Across the studies, sow feed intake was a key driver of improved litter weight but nutrient density also played a major role.

In separate work, small pigs (approximately 5.5kg) were allowed to suckle the sow for an extra three weeks, after which they were offered a commercial dietary regime. A comparator group of small pigs were weaned at four weeks and followed a similar commercial dietary regime to slaughter. The extended suckled group had superior finishing performance, likely due to dietary management matching their weight better. The economic difference between the two groups was £5.40 a pig. This would be worth at least £1 million for the local pig industry.

Enhancing the environment of the farrowing house to encourage high sow feed intakes improves piglet weaning weight. Further economic gains could be made by increasing the precision of matching dietary changes to weight development for low weight piglets.

Thumbs up for Northern Ireland lamb

Consumers say yes to local lamb

Sales of Northern Ireland lamb face strong competition from New Zealand lamb from December to March each year, prior to the introduction of spring lamb on the UK market.

Research Leads:
Terence Hagan, Linda Farmer, David Sanderson and Alan Gordon

Funding:
Livestock and Meat Commission for Northern Ireland

A project, funded by the Livestock and Meat Commission for Northern Ireland, investigated the eating quality of local lamb loin from female and entire male lambs, compared to younger New Zealand-sourced lambs.

The Northern Ireland lambs were selected from commercial production. All animals were between nine and 12 months of age and were classed as 'young lambs'. The lamb loins were used without ageing. Lamb from New Zealand was sampled from meat imported commercially during the same period. The New Zealand lambs were five to six months of age at slaughter and the meat had been aged for more than 45 days in transit.

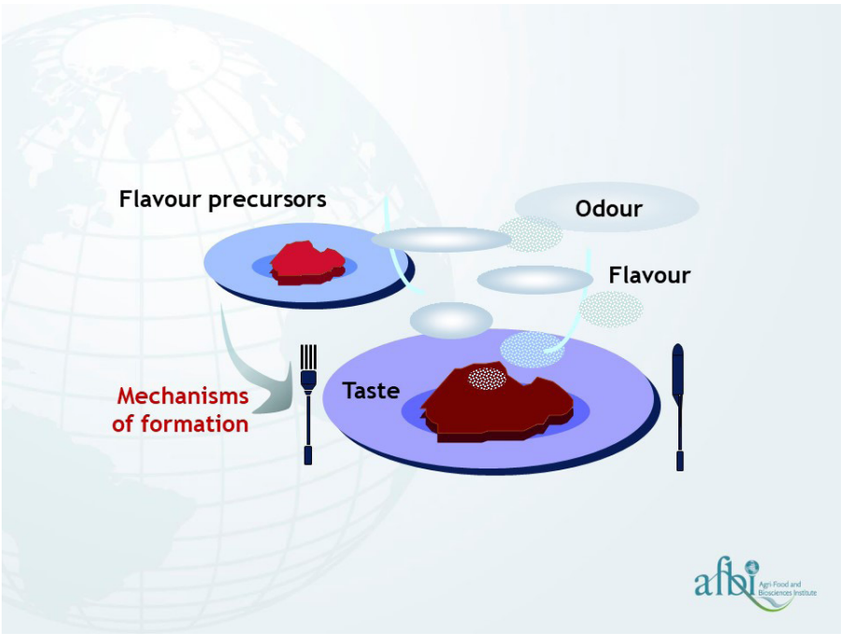
One hundred and twenty consumers assessed the lamb from the different sources. Key attributes of aroma, tenderness, juiciness, flavour liking and overall liking were assessed on a score of zero to 100 with 100 being 'liked extremely' or 'very juicy/tender'. They also assessed the acceptability of the samples on a scale from 'unsatisfactory' through 'satisfactory everyday quality' and 'better than everyday quality' to 'premium'. The consumer comparisons showed that loin meat from local lamb, slaughtered at just under 12 months, without meat ageing, was of equal acceptability to the New Zealand lamb.

This was despite the NZ lamb being only four to six months at slaughter and having been aged for at least 45 days.

None of the consumer panels showed any difference between local male and female lambs. There was no evidence that meat from male lambs was less liked than that from female lambs at nine to twelve months of age. This is a positive and welcome outcome for the local industry. It confirms that Northern Ireland-produced lamb can be bought with confidence throughout the year, since eating quality matches imported 'spring born' lamb from New Zealand.

Making beef a flavour to savour

A meeting of partners from AFBI, Texas Tech University, Teys and Birkenwood (Australia) was hosted at AFBI in August 2017.



Traditionally consumer attention has focused on the tenderness of beef, rather than its flavour. However, there is evidence that, provided the meat is not overly tough, consumers value flavour just as much as tenderness.

To address this, AFBI Food Research Branch is working with companies and researchers globally to deliver a consistently good beef flavour experience.

Beef flavour is made up of taste and aroma, both of which are detected during eating. Between 20 and 40 substances contribute to the aroma and flavour of cooked meat. Many of these compounds are formed by a small number of reactions.

Key odour compounds are present in very low concentrations and are difficult to detect by routine methods. For this reason research has focussed on identifying 'marker compounds' for flavour as they behave in the same way but are easier to monitor.

Results from AFBI research indicate that compounds from the same formation pathway are associated with each other and with what consumers view as positive for flavour. This indicates that these compounds may be used as markers for flavour satisfaction.

If we can understand why some cuts or products lack flavour, then it should be possible to design treatments to optimise flavour formation. AFBI is working with scientists and industry experts in the United States and Australia to develop this concept and use it commercially.

Research Leads:
Linda Farmer, David Farrell, Terence Hagan and Colin McRoberts

Funding:
Meat and Livestock Australia, Teys and Birkenwood pty Ltd, Australia.

Fish stock – what's the catch?

Towards maximum sustainable yield of Irish Sea fisheries

AFBI is advancing fisheries management towards the long-term sustainability of Northern Ireland's fishing industry, using data collected by AFBI scientists in collaboration with industry partners.

Research Leads:
Mathieu Lundy and
Pieter-Jan Schön

Funding:
DAERA

Through a programme of internationally coordinated work, led by AFBI, new assessment methods have been developed for a range of Irish Sea fish stocks. These are a fundamental step towards achieving a maximum sustainable yield (MSY). This is the point at which the largest catch can be taken from a stock without limiting future stock size.

The adoption of the new methods has resulted from years of effort invested in improving the information and data collected by AFBI scientists. The information came from surveys carried out on-board AFBI's research vessel, RV Corystes, from commercial fisheries and through fishery/science partnerships.

This enabled an accurate assessment of the condition of fish stock and the pressures on it.

The resulting scientific advice published by the International Council for the Exploration of the Seas has lead to the most positive outcome, relating to the sustainability of Irish Sea fish stock for nearly two decades. While maintaining sustainable harvest limits, the scientific advice translated into proposals to increase catch opportunities for the fishing industry in 2018 by more than half for cod, haddock, plaice and herring compared to the total allowable catches for 2017. This will provide long-term biological, economical and social sustainability for the Northern Ireland fishing industry and associated community in the years ahead.

AFBI also plays a leading role in providing scientific advice for the internationally shared fish and shellfish stocks in the Irish Sea. The goal is the sustainable management of all commercially exploited stock. All shared stock in the Irish Sea now have MSY targets. These allow a flexible response to changes in stock size and are an important step towards long term sustainability and an ecosystem-based approach to managing fisheries.

Beyond Sargasso

A sustainable future for eel fishing

The European eel is a wide-ranging species that exists in fresh water from the Nile to the Azores, and from Morocco to Iceland. There is a level of mystery around its life cycle as it has a single oceanic breeding ground, believed to be in the Sargasso Sea, near the Bahamas.

Research Leads:
Derek Evans and Robert Rosell

Funding:
DAERA and Lough Neagh Eel Fishery Cooperative

The viability of the eel industry across Europe depends on the health of this global population and its ability to provide juvenile eels. Numbers of juvenile "glass" eel recruiting from the ocean to freshwater have been on a downward trend since 1983.

AFBI is a key player in European eel research. This is a result of its successful partnership with the Lough Neagh Eel Fishery, combined with research on the conservation of wild populations. This breadth of experience has earned AFBI's fishery scientists key influential roles within the International Council for the Exploration of the Seas (ICES), the United Nations European Inland Fishery and Aquaculture Advisory Commission (EIFAAC) and the European Commission's Scientific Technical and Economic Committee for Fisheries (STECF).

Since 2003 AFBI has been at the forefront of designing and fine-tuning ways to assess compliance with EU conservation targets for silver eel escapement to spawning stocks. Eel research and monitoring by AFBI centres on the delivery of advice from projects across the eel's life cycle. Findings and their impact on the management of commercial or conservation-linked fisheries, are readily applied to industry practice and management action.

Techniques developed by AFBI are being used to improve eel management and compliance monitoring across the EU. Nevertheless, the UK commercial eel fishing sector, faces a major challenge to maintain designated sustainable status beyond the European Union. To that end, AFBI's research and analytical skills are addressing the potential impact of fisheries, while continuing to develop new approaches to maintaining the long term viability of the eel stock.

Veterinary epidemiology & bovine tuberculosis

How present patterns shape future planning

Veterinary Epidemiology is a study of the patterns and processes driving infection within and across animal populations. The aim is to deliver successful interventions to improve productivity and welfare outcomes, while reducing costs and disease risk.

Research Leads:
Andrew Byrne

Funding:
DAERA

Ultimately, Veterinary Epidemiology is a science that identifies and quantifies risk. It is the bedrock of a sound evidence base for policy makers and farmers seeking to establish how best to control disease from the individual herd, up to the national scale.

At AFBI, Veterinary Epidemiology has focused in recent years on the complex problem of bovine tuberculosis (bTB). This is one of the most pressing and costly animal health concerns in Northern Ireland. Research by the Veterinary Epidemiology group included assessing the role of the badger, a known wildlife reservoir, in cattle herd breakdowns.

AFBI has also contributed to the understanding and performance of tests to detect infection in cattle. Recent research highlighted a significant risk to farmers who choose not to cull cattle which tested positive for interferon gamma (a sensitive laboratory-based test for bTB). Such choices were shown to be epidemiologically and financially risky. The group has also recently embarked on a study into the potential impacts of co-infection, when animals are burdened with more than one disease. In this case they tested bovine viral diarrhoea (BVD), Johne's disease and liver fluke and their link to the diagnosis and spread of bTB. This confirmed the value of epidemiology research. As well as insights into the dynamics of co-infection, this AFBI research has improved knowledge of the risk factors associated with BVD within herds and the variation in liver fluke risk across Northern Ireland. These insights will be of great value to policy makers in developing future approaches.

Egg-stremely important research

Protecting the Reputation of Northern Ireland Eggs.

The illegal use of Fipronil in laying hens began in the Netherlands, but spread to become a major human health issue across Europe and beyond. First reported in late summer 2017, AFBI was closely involved in confirming that the industry here was not affected.

Research Leads:
Steven Crooks

Funding:
DAERA

Fipronil is a commonly-used insecticide for the control of lice, mites and other parasites on domestic animals. It is not approved for use in animals or food products destined for the human food chain. According to the World Health Organisation, Fipronil is moderately toxic and can damage the liver, thyroid glands and kidneys if ingested in large amounts over time.

The use of Fipronil on Dutch Poultry farms saw the contamination of Dutch eggs on 180 farms. Many of these eggs had been exported, meaning the contamination had a significant impact on the industry throughout Europe. It led to the recall and destruction of millions of eggs.

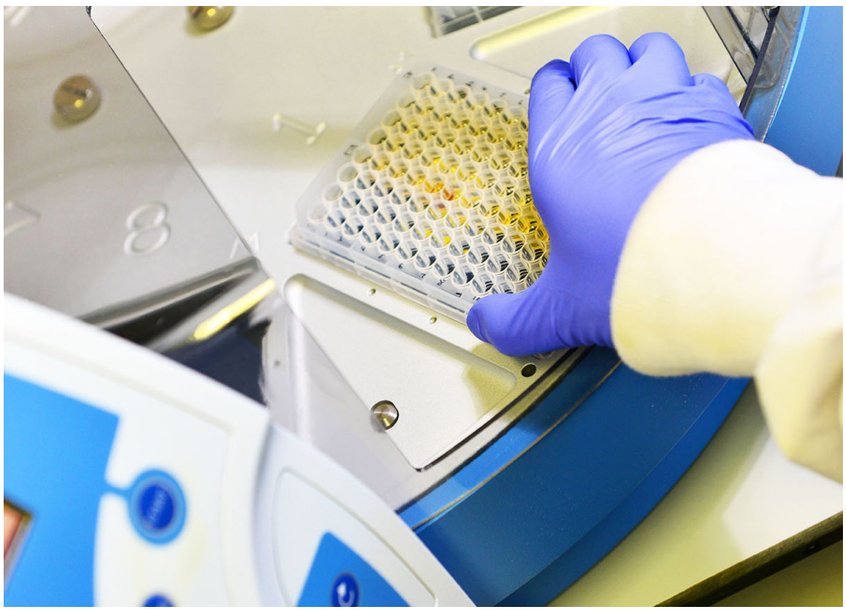
At the height of the crisis the UK Food Standards Agency advised that around 700,000 eggs imported into the UK could have been contaminated. To minimise consumer panic it made clear that this represented just 0.007% of the eggs eaten in the UK each year. Nonetheless, the government commissioned testing to reassure people about the safety of UK eggs.

AFBI scientists responsed to the challenge and developed and implemented a test method for the detection of Fipronil residues. It was based on the latest highly sensitive liquid chromatography mass spectrometry technology. Thanks to the the speed of AFBI's response, the analysis of Northern Ireland eggs began within days of the UK contamination reports emerging.

The method used by AFBI and subsequent testing played a key role in the UK response to the discovery of Fipronil in European eggs. Crucially, it helped protect the reputation of Northern Ireland's egg production industry, with tests confirming all local eggs were free from residues.

Private investigators wanted

Why disease surveillance is needed in the animal world



Disease surveillance is about collecting evidence on animal health and welfare to provide an early warning of new and emerging threats. Rapid action can then be taken to minimise their impact. Surveillance also includes diseases that could pose a threat to human health, even where they are not apparent in the animal.

In Northern Ireland, veterinary disease surveillance is carried out by AFBI. A key aspect is the collection and analysis of information from carcasses and diagnostic samples which are sent to AFBI laboratories at Omagh and Stormont. The results not only have an impact on disease control at farm level, but provide evidence of the regional or national animal health status. This supports trade in livestock and animal products and is vital as Northern Ireland seeks to expand access to non-EU markets.

AFBI also has important links with disease surveillance providers beyond Northern Ireland. AFBI staff are members of the UK-level disease expert group, the European Pathosurveillance Network and the European Veterinary Surveillance Network (EVSN) – each are forums to discuss emerging threats and the best surveillance methods.

A number of disease surveillance documents are produced, including a quarterly report in the Veterinary Record. The All-island Animal Disease Surveillance report is a joint AFBI/ Department of Agriculture, Food and the Marine (DAFM) publication. It has been issued annually since 2011 and reflects close collaboration and the amalgamation of surveillance information. Data are also incorporated into national and European reports, including the UK Zoonosis Report, the European Food Safety Authority (EFSA) Trends and Sources report, One Health report and the Veterinary Antimicrobial Resistance and Sales Surveillance (VARSS) report.
A key part of the AFBI surveillance programme is getting information out to the local industry. This is not only through official reports but also through the media, a surveillance newsletter and participation in technology transfer events, such as farm walks and by working with local vets.

Veterinary surveillance is vital as it underpins an efficient farming industry, protects animal and public health and delivers the key scientific evidence on animal health that is the basis of international trade.

Research Leads:
Maria Guelbenzu

Funding:
DAERA

Clamping down on Campylobacter

Enhanced food safety thanks to AFBI research

Campylobacter remains the main cause of bacterial food poisoning in humans across the developed world.

For more than twenty years, AFBI has maintained an international reputation for research into the detection, characterisation and control of Campylobacter in the food chain.

This has been driven by scientists from AFBI who have participated in UK and EU Campylobacter networks. This collaboration has led to AFBI providing a rapid on-farm testing service to the poultry industry across the UK, resulting in significantly improved farm management practices.

Current Campylobacter research projects are focussed on understanding more about the virulence of the pathogen and developing novel control strategies. More recent studies have investigated host-pathogen interactions and the molecular basis of pathogenesis.

Approaches such as whole genome sequencing of Campylobacter have allowed the genetic factors controlling pathogenic properties to be investigated.

Research is also being conducted into practical strategies to improve productivity while reducing pathogen levels in poultry production. These include investigating new pathogenic properties, developing new probiotics and using prebiotics, such as essential oils, to improve gut health and reduce pathogen levels.

Research into potential Campylobacter vaccines is also underway within AFBI.

Research Leads:
Nicolae Corcionivoschi

Funding:
Various funders

Detection = Protection

Preventing the spread of avian flu to the poultry industry in Northern Ireland

Highly Pathogenic H5N8 avian influenza (HPAI) first emerged across Europe and Asia in 2014. It caused deaths in wild bird populations and outbreaks in domestic poultry flocks. In 2016, H5N8 re-emerged. The virus was first detected in a wild swan in Hungary in October, with a subsequent outbreak at a commercial turkey farm in November.

Research Leads:
Ken Lemon

Funding:
DAERA

By February 2017, there were 26 detections in the UK, of which eight were in poultry. Three were in flocks of more than 10,000 birds. Although there is currently no evidence for human infection and the risk is considered low, the pandemic potential of H5 and H7 avian influenza subtypes requires control measures upon detection.

The Veterinary Sciences Division (VSD) at AFBI is responsible for surveillance and detection of epizootic disease threats and contingency planning. Early in 2017 H5N8 was detected in wild bird species across mainland Europe as well as in the UK and Republic of Ireland. Four cases, in three swans and a goose, were detected in Northern Ireland.

Identification by the AFBI team involved detection of influenza A virus. This test can detect the virus regardless of subtype or species of origin. The AFBI team quickly established that the swans and goose were positive for influenza virus. Subsequent tests confirmed the presence of H5N8 HPAI.

AFBI and DAERA increased surveillance activity in response to the heightened threat. Poultry keepers were urged to reinforce biosecurity measures to help reduce the risk and DAERA put an Avian Influenza Prevention Zone (AIPZ) in place. This highlights the importance of maintaining cutting-edge local capabilities to respond to emerging disease threats. The rapid detection of HPAI by AFBI underlines the critical role of AFBI in safeguarding the local poultry industry as a key part of the local economy.

AgroForestry…

The Way to Go

Ash trees of sufficient size sold as renewable fuel and into the lucrative Hurley stick market in Northern Ireland.

Protected broadleaved trees planted at wide spacing into ryegrass sward and compared with open pasture (AFBI Loughgall).

Agroforestry is a sustainable land use practice, where widely-spaced trees are grown in pasture to maximize benefits for farmers.

AFBI has been involved in agroforestry research since 1989, initially as part of UK and EU networks investigating the effects of tree density on sheep production, pasture production and ecosystem services delivery.

AFBI research has shown that trees can be successfully integrated and grown in pasture. The impact on grassland management practice is minimal. In AFBI trials, grass growth and livestock production under widely-spaced ash trees were not reduced until trees were 13 years old. Over that time significant environmental benefits were delivered.

Trees grown in pasture can extend the grazing season, so improving grass utilisation. They also help grazing resilience during extreme rainfall, increase biodiversity and carbon sequestration and provide renewable fuel. Other environmental benefits demonstrated in AFBI research include reduced wind and temperature stress on animals, root differentiation, improved soil structure and less leaching of nutrients. Economic predictions are positive. These come from farmer surveys, recommendation in the Sustainable Agricultural Land Management Strategy and inclusion in the current Environmental Farming Scheme. Uptake on commercial farms across Northern Ireland has shown that agroforesty is a realistic land-use option that delivers key objectives in managed landscapes.

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Funding:
DAERA EU FP7

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