

R&D Review 2018/19



Contents

3 Introduction

Completed projects

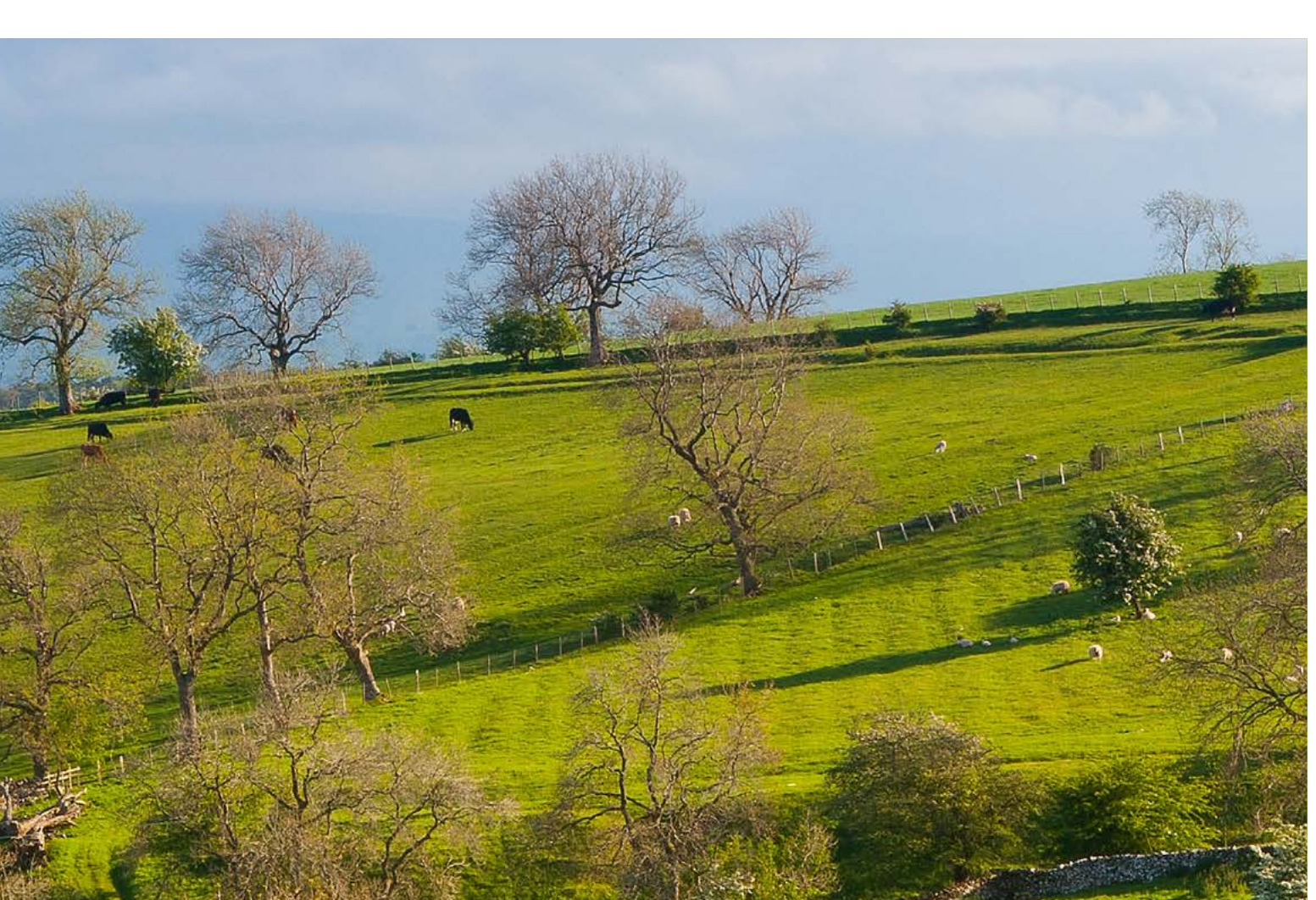
- 4 What have we learned from RamCompare?
- 5 Making faster genetic gain in carcase traits
- 5 Selecting sheep for dealing with low levels of cobalt
- 6 Better understanding of the spread of footrot between sheep
- 7 Better diagnostics for *Neospora caninum*
- 8 Improving grassland management on beef farms
- 9 Using technology to assess grass growth
- 9 Updating sulphur availability from organic materials
- 10 Reducing waste in silage clamps
- 11 Carcase and meat quality activity
- 12 Developing sheep expertise
- 13 Developing diagnostics

Current projects

- 14 Selecting for feed efficiency
 - 15 Breeding for parasite resistance
 - 15 Future opportunities for sheep breed improvement
 - 16 Responsible antibiotic use
 - 18 Evaluating beef finishing units
 - 18 Youngstock health activity
 - 19 Beef parasite activity
 - 20 Increasing expertise in pathology
 - 20 Improving understanding of laryngeal chondritis
 - 21 Reviewing chronic wasting diseases in sheep
 - 22 Feed into Beef
 - 23 Beef in arable rotations
 - 23 Outdoor dairy beef
 - 24 Enhancing soil biology and improving soil health
 - 24 Grass and herbal leys network
 - 25 Challenge Sheep
 - 25 Farmbench in research projects
-
- 26 Other projects
 - 27 Studentships
 - 29 R&D process
 - 30 Glossary
 - 31 Meet the team

Photography: Farm Post Mortems Ltd,
Fiona Lovatt (Flock Health Ltd), Katie Waine,
Kingston University, Rachel Clifton
(University of Warwick), Scotland's Rural
College (SRUC), University of Liverpool.





Introduction

I hope you enjoy the fourth edition of the AHDB Beef & Lamb R&D Review. You will find a summary of some of the work the organisation is carrying out on behalf of our levy payers to help their business become more efficient and sustainable, which is now more important than ever as Brexit approaches.

A priority area for Beef & Lamb in AHDB's 'Inspiring Success' strategy is to accelerate innovation and productivity growth through coordinated research and development (R&D) and knowledge exchange (KE). We have set a target to increase farm profitability, per hectare, over a four-year period of 5 per cent. This will be measured by comparing performance of approved Farmbench users benchmarking for any two consecutive years, indexed to remove volatility.

To achieve this, we have ongoing work with the RamCompare project to help increase the use of Estimated Breeding Values (EBVs) on farm, along with work to enable the breeding of sheep with genetic resistance to worms. On the cattle side, we have the Beef Feed Efficiency Programme aiming to enable the selection of animals that eat less but grow at the same rate, which will mean more efficient beef production.

Growing resistance to antibiotics is an important issue, not just for human health, but also for the livestock

industry, with pressure from Government to reduce usage by 2020. We have a number of projects across the beef and lamb sectors to help us better understand the use of antibiotics on beef and sheep farms, as well as work to help farmers improve the health of their livestock so there is less need for antibiotics in the first place.

AHDB Beef & Lamb funds around 25 research projects every year, as well as a number of PhD studentships. Unfortunately, it can't all be covered in this review. If you would like more information on all the activity we are involved in, as well as resources that have been produced from our R&D work, take a look at our website beefandlamb@ahdb.org.uk



Adam Quinney
AHDB Beef & Lamb
Sector Chair



Lambs from RamCompare sires



Ultrasound scan of third lumbar vertebrae

Completed projects

What have we learned from RamCompare?

Full results from the first phase of the RamCompare project were released to industry in July 2018. The project aims to help the sheep industry drive genetic improvement forward through the inclusion of commercial data in genetic evaluations. Over two years, performance data of 8,000 commercial lambs sired by 70 rams of different terminal breeds has been collected.

Partners from right along the supply chain are involved in the project to get lamb performance data from farms and abattoirs included in genetic evaluation.

Existing EBVs for traits measured on farm, such as scan weight, muscle depth and fat depth, have been updated using data from the lambs, which have been reared under commercial conditions.

Three new EBVs have been generated for carcass conformation, fat class and carcass weight – as well as an overall index for carcass merit.

The project showed that the selection of rams on the basis of widely available EBVs will enhance the performance of slaughter lambs. Real financial differences can be found between the progeny of the best genetic merit rams and more average rams, with typical benefits of £4–5 per lamb routinely observed.

Computed tomography (CT) scanning has been used to deliver CT-derived EBVs, which provide a more informative insight when selecting rams than was first thought. Each year, levy funding is used to carry out CT scans on over 500 potential breeding rams to assess their carcass merit. RamCompare results show that rams that excel in traits like CT lean weight are more likely to produce more valuable progeny for slaughter.

The project highlighted that all the UK's terminal sire breeds have strengths and weaknesses. Those that, typically, give the fastest on-farm growth rates did not always produce the heaviest carcasses. Farmers must think about the traits they need in their production system and obtain rams with the right EBVs to optimise production.

RamCompare demonstrated it is possible to convert abattoir data into meaningful EBVs and that much of the variation between lambs is due to their genetics. The project also showed lambs can be scanned by ultrasound at younger ages, provided they are heavy enough, leading to shifts in the way we record lambs in pedigree flocks.

RamCompare has shown that the use of EBVs can markedly enhance productivity and profitability.

In 2017, it was announced RamCompare would continue for another three breeding seasons (2017/18, 2018/19 and 2019/20) and will include other terminal breeds being tested for the first time. Further research will look at genetic influences on tenderness and primal yield, as well as days to slaughter.

For more information on RamCompare, visit ramcompare.com

RamCompare is an industry-led project involving partners from along the supply chain including AgriSearch, AHDB Beef & Lamb, Dunbia, Hybu Cig Cymru – Meat Promotion Wales (HCC), Quality Meat Scotland (QMS), Randall Parker Foods and Sainsbury's.



Ram in a CT scanner

Making faster genetic gain in carcase traits

CT scanning has been incorporated into sire sheep breeding programmes in the UK for over 20 years. By identifying individuals with superior carcase composition, higher rates of genetic gain have been achieved in flocks that use CT scanning.

The ability to measure other traits derived from CT images adds further value to the CT scanning process.

- Significant variation in spine traits (number and length) has been identified both within and between breeds
- Information on tissue densities provides fairly good estimates of intramuscular fat (IMF) in the loin of the live animal
- Measures of eye muscle area from CT scans will help breeders wanting to increase muscling within the loin

Research has been undertaken at Scotland's Rural College (SRUC) to determine the extent to which these new CT traits are influenced by an animal's genes. SRUC was also asked to look at the impact of adjusting traits for liveweight, rather than the age of the animal, as Signet does currently.

Table 1. New heritability for weight-adjusted traits

Trait (weight adjusted)	New heritability values (h^2)
CT carcase fat weight (kg)	0.54
CT carcase muscle weight (kg)	0.54
CT measured gigot muscularity	0.36
CT measured eye muscle area (cm^2)	0.41
Total spine length (mm)	0.18
Total vertebrae number	0.20
CT predicted intramuscular fat in the loin (%)	0.40

Selecting sheep for dealing with low levels of cobalt

Cobalt deficiency is relatively common in England because some areas of the country have low soil cobalt levels. It causes poor lamb growth rate because cobalt is needed by the microbes in the rumen to manufacture vitamin B12, which is important for growth.

Low levels of cobalt impact lamb price because higher market prices may be missed or lambs don't reach their potential.

Commonly, boluses or drenches are used to provide cobalt to weaned lambs, or injections of long-acting vitamin B12 can be used to reduce the need for additional cobalt, but this can be costly.

Research has been carried out to identify the genes that lead to an animal's susceptibility to deficiencies, with the aim to select animals more resilient to low levels of cobalt, meaning farmers would not need to use expensive supplements.

Samples of DNA were collected from Texel lambs and a list of genes connected with susceptibility to cobalt deficiency was identified. Texel lambs were then selected, based on their genes, fed diets with different levels of cobalt and their performance monitored.

The project has led to the identification of genes that determine animals' susceptibility to cobalt deficiency, which could be used in future genomic selection.

This project was mainly funded by Biotechnology and Biological Sciences Research Council (BBSRC) and was conducted by the University of Nottingham and Roslin Institute. It was an industry partnership award with AHDB Beef & Lamb, HCC and Agrisearch involved in the industrial collaboration.

Better understanding of the spread of footrot between sheep

Footrot is an infectious cause of lameness in sheep that has health and welfare implications for the individual sheep affected as well as significant economic consequences for the farm. It is caused by a bacteria called *Dichelobacter nodosus*. A secondary bacteria called *Fusobacterium necrophorum* increases the severity of footrot lesions.

F. necrophorum is opportunistic, meaning that reservoirs of the bacteria live in healthy individuals or their environment. In the case of footrot, these were believed to be the soil of sheep pasture and sheep dung. However, evidence for this is sparse, with data suggesting mouths were a source.

Rachel Clifton completed a PhD at the University of Warwick to examine populations of *F. necrophorum*. The project developed a laboratory test to identify different strains of *F. necrophorum* and used this to compare communities of the bacteria at different sites in sheep to help understand the spread of the bacteria within flocks.

The laboratory test Rachel developed is an MLVA typing scheme (multiple locus variable number tandem repeat analysis) which is sensitive, specific, stable and discriminatory. This means there is a low probability that a positive or negative result returned by the test is incorrect and that the test is able to differentiate between species and strains of bacteria to give an accurate result.

The new laboratory test is accurate, meaning there is low probability that results returned are incorrect.

The laboratory test has revealed differences in the communities and strains of *F. necrophorum* found on the feet and in mouths. The results of Rachel's research will be published later this year and will improve our understanding of the spread of footrot between animals.

Funded by NERC, AHDB Beef & Lamb, MSD Ruminant Research Bursary and Medical & Life Sciences Research Fund.



Better diagnostics for *Neospora caninum*

PhD student Stefano Guido's research aimed to improve the diagnostic tools available for detection of Neosporosis in cattle.

Caused by *Neospora caninum*, it is a major cause of abortion in cattle worldwide, usually occurring between the fourth and seventh month of gestation, at rates ranging between 5 to 30 per cent in infected herds. There is no effective vaccination or treatment available, which means being able to diagnose infected cattle accurately and as soon as possible is vital in controlling this disease.

N. caninum is a protozoan parasite that can infect dogs as well as cattle. In cattle, it is able to establish lifelong persistent infections.

In cattle, infection may occur by:

- Vertical transmission: where the parasite is transmitted during pregnancy from an infected dam to its foetus
- Horizontal transmission: the cow ingests infective parasite eggs (oocysts) that are shed in the faeces of infected dogs and may contaminate feed and pasture grass (Figure 1)

Currently, the methods available to diagnose and confirm infection with the parasite, are:

- Post-mortem: identification of characteristic lesions in aborted fetuses (brain, heart) associated with the direct detection of the parasite or its DNA
- In live animals: detection of antibodies in the blood or milk

Different strains of the parasite can be identified in a herd because of the genetic variation of *N. caninum*.

A molecular tool that enables discrimination between strains was developed to identify the likely source of infection and the main transmission route (vertical or horizontal) at herd level. This information will help to develop appropriate on-farm control strategies.

Antibody levels to *N. caninum* fluctuate throughout the life of infected animals, which means false negative results may occur when animals are infected but antibody levels are too low to be detected. There are two life cycle stages of *N. caninum*: the slowly multiplying bradyzoite stage, which establishes persistent infections and the rapidly proliferating tachyzoite stage found during acute infections (Figure 1). Following the establishment of persistent infections, the antibody levels during the tachyzoite stage may decline below the detection limits of currently available diagnostic tests.

Two new antigens expressed by the bradyzoite stage of *N. caninum* have been identified, enabling the identification of cattle that, despite harbouring *N. caninum*, consistently tested negative with current tests based on tachyzoite antigens. Preliminary data demonstrated that both antigens can be useful for the identification of persistently infected animals.

Work from Stefano's PhD was instrumental in changing the Cattle Health Certification Standards (CHeCS) guidelines on testing cattle for Neospora. The advice had previously been to test 12 to 4 weeks pre-calving but this has been removed as Stefano found no evidence that sampling cattle at specific reproductive stages would significantly increase the chances of detecting animals with Neosporosis.

Funded by AHDB Beef & Lamb at the Moredun Research Institute

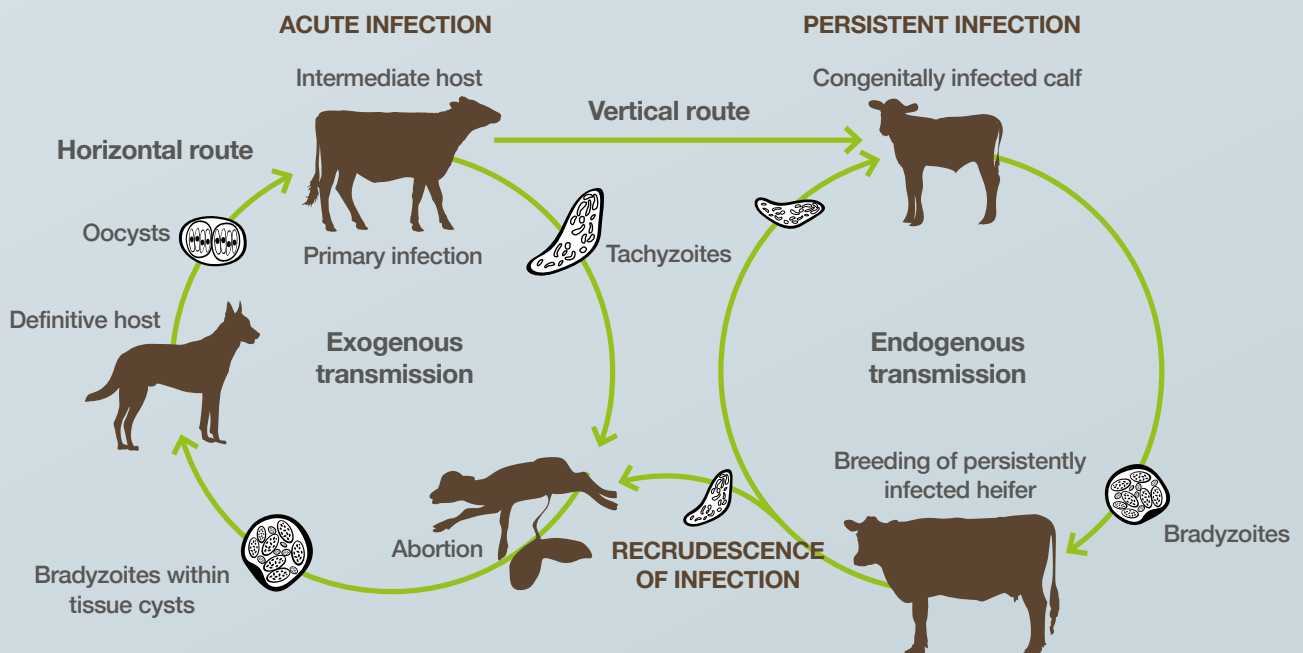


Figure 1. Life cycle of *N. caninum* (adapted from Guido *et al.*, 2016)



Improving grassland management on beef farms

Grazed grass is the cheapest feed on farm. When well managed, it has the potential to reduce input costs significantly, in particular bought-in feed.

The Beef from Grass project aimed to provide practical guidance to farmers on how grazing management can be improved. The progress of four suckler beef farmers who wanted to improve their grazing management was monitored. They all received advice from a grassland consultant and had a mentor who was either a beef or dairy farmer.

On each of the four farms, three targets were identified and used as project goals; they included:

- Number of days cattle were housed
- Stocking rates across the grazing platform
- Cattle growth rates from grazing and silage/forage

The farms were encouraged to implement rotational grazing, outwintering and reseeding, with the aim of producing more beef from grass and forage. They all took soil samples to check soil nutrient status including pH, phosphate, potash and magnesium.

The pH of soil can impact the uptake of nutrients and so making sure it was correct was critical for optimum growth.

All four of the farmers implemented rotational grazing, with fields split up using electric fencing and positioned water troughs. Grass growth was measured weekly using a plate meter and recorded using the grassland monitoring software AgriNet. Animals entered a paddock at 2,800kg of dry matter per hectare (DM/ha) and were removed when grass cover reached 1,500kg DM/ha. Rotations lasted 21 days, with cattle spending three days in each paddock before being moved to the next.

Each of the farmers managed to achieve growth rates well above the 1.1kg per day target during the grazing season.

By implementing rotational grazing and reseeding poorly performing fields, grass growth was doubled. Growth increased from an average of 4.7 tonnes (t) per hectare at the start of the project to 8.4t per hectare at the end. This meant the farmers could increase herd size, with average stocking rates increasing to 1.8 livestock units (LSU) per hectare.

Two of the farms also outwintered cattle on either deferred grazing or forage crops, supplemented with conserved forage. When all costs were calculated, a saving of £1.25 per head per day was made during the winter period.

The changes made by the four project farms have increased their average gross margin by 40 per cent to £649 per hectare. This means they are well on their way to achieving a gross margin of £1,000 per hectare, which compares favourably with cereal gross margins. Targets for grassland management have been created, based on the results of this project (Table 2).

Table 2. Targets for producing beef from grass

Key performance indicator	Target
Grass grown per hectare (t)	12–15
Stocking rate per hectare (LSU)	1.5–2
Daily liveweight gain across grazing season (kg/day)	1.1
Gross margin per hectare (£)	600–1,000

A BRP+ document will be produced with further information on how to improve grassland management on beef farms.

The project has been extended to track the progress of the existing farmers who will become mentors to some of the strategic beef farms that want to improve grassland management.

Funded by AHDB Beef & Lamb.



Using technology to assess grass growth

Work in Australia and New Zealand has shown that satellite images can be used to predict grass growth by comparing two images several days apart and calculating the difference in terms of kg of DM per ha per day. This project evaluated whether similar technology could be used in the UK.

The use of this technology could help farmers improve yield and quality by optimising the timing of silage harvest, producing grass growth curves for benchmarking and creating yield and quality maps that will enable precision management of inputs.

Results from the predictions based on satellite images were compared with results from farmers who regularly measure grass ('ground truthing').

Overall, it was possible to use optical satellite images to calculate the amount of grass in a field. However, images were not always available due to cloud cover, with good-quality images only available every few weeks. Also, as grass moved towards silage, the satellite images couldn't accurately assess the amount of grass available, probably due to the grass bending over as the stem extends.

The next step is to see if results from satellite images, with gaps filled in with predictions based on grass growth models and weather data, could be built into apps to help farmers make better decisions based on data. Also, more sites need to be tested and work is needed to improve the accuracy of longer or denser crops.

Funded mainly by Innovate UK with support from AHDB Beef & Lamb.

Updating sulphur availability from organic materials

Sulphur deficiencies can lead to yield losses in grass fields of up to 30 percent and is becoming more common because less is being deposited from the air. Organic materials are used on about 65 per cent of farms in Britain and can be an important source of sulphur,

however availability varies. In Section 2 of the **AHDB Nutrient Management Guide (RB209)**, total sulphur levels are presented in tables with guidance on the percentage of sulphur available.

Table 3. Current sulphur availability from organic materials

Organic material	Total SO ₃ available (%)
Autumn applied	
Livestock manures	5–10
Biosolids	10–20 ^a
Spring applied	
Cattle FYM	15
Pig FYM	25
Poultry manure	60
Cattle/pig slurry	35
Biosolids	20

^a = 20–35% before oilseed rape.

From 2014 to 2017, trials were run on five sites using cattle slurry, pig slurry, broiler litter and two types of bio-solids to investigate the sulphur available from organic materials with a view to update the guidance. Oilseed rape was used in the trial because it is the most sulphur-sensitive crop, closely followed by grass, and the organic materials were applied in autumn.

Results show that the percentage of available sulphur within organic fertilisers is more than predicted and so the tables within the **AHDB Nutrient Management Guide (RB209)** can be updated. For example, autumn-applied livestock manures and bio-solids provide 20 per cent and 10–15 per cent respectively, and cattle/pig slurry and bio-solids applied in spring provide 40–50 per cent and 30–40 per cent respectively.

These new recommendations will be part of the updates to Section 2 of the **AHDB Nutrient Management Guide (RB209)** in 2019. They will lead to cost savings on farms using organic materials because less sulphur-containing fertiliser will need to be purchased.

Funded by AHDB Beef & Lamb.

Reducing waste in silage clamps

The variability in quality of grass silage in clamps from 20 farms in England has been examined and the factors associated with differences in quality, both within a clamp on a single farm and between clamps on different farms, identified.

The evaluations showed that, on average, 27 per cent of the volume and 21 per cent of the fresh weight in a clamp is in the 'vulnerable zone', which is the area 0.5m from the side wall or top sheet. Many farmers disregard this portion as being 'the bits round the side' but when the silage in this area is worth, on average, £4,000, it is important to manage losses to get the most out of the clamp.

Clamp filling management is the one factor that should be under the control of all farmers, even if done by a contractor. It is the biggest factor affecting silage quality because it drives in-silo losses and feed-out losses caused by heating of silage and aerobic spoilage.

Density was identified as another important factor, with poor density leading to poorer preservation quality and secondary fermentation. This is where products of the primary fermentation, normally lactic acid, are converted to secondary fermentation products such as acetic and butyric acids by undesirable silage microorganisms because of the presence of oxygen trapped at the beginning of the storage period. Poor density also increases the ingress of oxygen during the entire storage period if sealing is inadequate and increases the risk of



aerobic spoilage or deterioration at feed-out because it allows oxygen to penetrate further into the silage from the open clamp face.

In terms of waste, nine of the 20 farms had no top or shoulder waste, with the range for the other clamps being 0.2 per cent to 36.7 per cent, which equates to £44 to over £8,000 of lost production.

Key actions to improve clamp storage quality:

- Ensure good compaction density of the whole clamp by having even layers, no more than 15cm (6 inches) deep, and adequately roll layer by layer
- Good side and top sheeting with sufficient overlap between the two to ensure a good seal
- Sufficient weight around the edge of the clamp, preferably sand bags touching, including down the ramp and along the front
- Sufficient top weight, ideally mats touching

By following these steps, clamp storage quality will be enhanced and DM losses between cutting and feeding reduced. It will also have a knock-on effect of reducing the losses in nutritional quality during storage.

It is also important to closely monitor crop maturity at harvest, and the link between stage of maturity and digestibility/metabolisable energy (ME) content needs to be known. It may be useful to start thinking about yield of protein and energy per hectare to ensure the focus is quality rather than just quantity.

These results will be used as the base for a technical manual on clamp silage production, which will be available in 2019.

Funded by AHDB Beef & Lamb.

Carcase and meat quality activity

AHDB is involved in various projects to improve the quality of beef and lamb meat in the UK. Given there is a wide range of factors that can influence quality, research is always ongoing and can cover a number of different areas.



Following a visit to the UK in summer 2017, AHDB has been working with Meat & Livestock Australia (MLA) to put British beef through the Meat Standards Australia (MSA) programme, with the aim of learning from their experiences. The programme undertakes a series of carcass and meat measurements that builds up a comprehensive picture of the eating quality of individual muscles on individual carcasses. The programme has been tested in several countries around the world, which has resulted in a huge database of around 700,000 samples.

Results have recently been analysed and UK beef performed as anticipated and in line with other countries. Carcasses selected for the trial were put through a strict consumer taste panel to gain understanding of consumer preference across the UK. It found consumers were able to discriminate between different quality beef products and different cuts. They also exhibited a 'willingness to pay', which closely reflected their preferences.

Retail Survey

As part of the AHDB Retail Survey, lamb loin and leg samples were purchased during the early part of 2017 to gain an insight into British lamb tenderness. This, combined with work in 2016, gave a full picture of British lamb, taking into account any new and old season variation. Results showed there was little difference between new and old season lamb loin with shear force results of 2.55kg and 2.44kg, respectively, and lamb topside at 3.95kg and 3.25kg. These differences are unlikely to be noticed by the human jaw. New Zealand lamb was also compared for tenderness at the same time, with a positive outcome, highlighting

that British old-season lamb (typically more tough) was only marginally tougher than New Zealand new-season lamb (typically considered to be more tender).

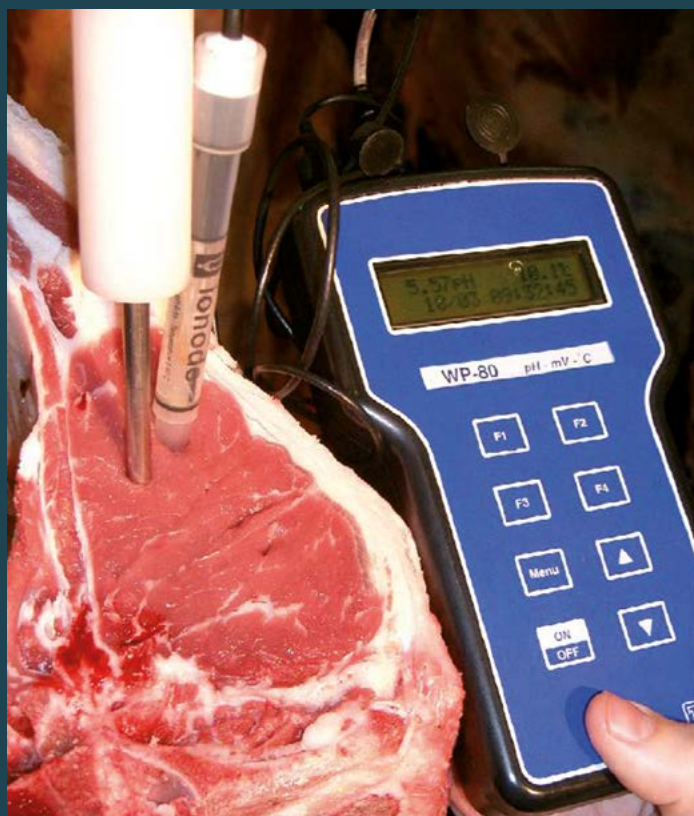
Meat Science Masterclass

With the success of the first Meat Science Masterclass in 2015, there has been an ongoing waiting list of delegates keen to attend. The course covers a vast amount of topics that have the potential to influence meat quality, from genetics and welfare, to chilling, packaging and much more. Aimed at people in practical roles, the course is designed to be interactive and informal, with demonstrations and group work taking place across the two days. The course is mostly delivered by Dr Peter Sheard, who ran the MSc Meat Science course at Bristol University for over 20 years. In addition, there are talks from AHDB staff covering topics such as quality assurance schemes, measuring meat quality and Halal slaughter.

The Meat Science Masterclass covers various factors that influence meat quality, including genetics, animal welfare, chilling and packaging.

Having a varied audience from the beef and lamb sector also allows the delegates to learn from each other and encourages discussion. The courses receive good feedback, and delegates also use it as a great opportunity to network and expand their contact base as well as their meat science knowledge.

For more information on the Meat Science Masterclass, email beeflamb.supplychain@ahdb.org.uk



Developing sheep expertise

The Developing Sheep Expertise programme offered continuous professional development (CPD) to consultants and advisers who wanted to expand their sheep knowledge. Sixteen vets and advisers passionate about sheep production came together for five meetings, which ran from December 2016 to November 2017.

The first three meetings were held between December 2016 and May 2017. They covered nutrition, including mineral and trace elements, health around lambing, benchmarking using Farmbench, ewe and lamb performance and discussions on approaches to consultancy.

The fourth meeting took place in Barnard Castle on 6 and 7 September. Day one began with Ian Cairns leading an exercise focused on understanding financial performance and on the second day there were discussions on key issues facing the industry. First, Fiona Lovatt led a debate on what the UK should do to tackle iceberg disease over the next 10 years. This was followed by discussion on antibiotic use in the sheep industry and how members thought this could be reduced, with important points raised concerning the industry and prescribing practices. The day closed with a guide to forage options on sheep farms and a practical session on how to generate a winter feed budget, led by Dr Liz Genever from AHDB.

The final meeting took place in Nottinghamshire on 15 and 16 November. The focus was on genetics and breeding and was joint with the Sheep Progressive Group, which is a group of forward-thinking farmers brought together by AHDB Beef & Lamb to develop their technical and business skills by providing them with access to industry experts. Samuel Boon from Signet Breeding Services



gave a presentation on EBVs, followed by a staged ram sale, which acted as a practical demonstration on selecting rams on EBVs for finishing lambs. Joining progressive farmers and vets together provoked interesting debate and discussion with each group giving the other valuable insight.

The programme of meetings was a mix of presentations and discussions, along with practical sessions which included a post-mortem session, body condition and worm control workshops. Delegates were also given facilitation and presentation skills training to help them deliver best-practice messages to farmers.

Details of the consultants and advisers who were part of the Developing Sheep Expertise Programme can be found online at beefandlamb.ahdb.org.uk/returns/developing-sheep-expertise



Developing diagnostics

Salmonella

Fredericka Mitchell at Kingston University has developed diagnostic tools for the detection of *Salmonella* infection in calves.

Salmonella enterica has an important role in foodborne disease, while *Salmonella dublin* is recognised as the main bacterial cause of diarrhoea in calves. Symptoms include diarrhoea, fever, depression and abortion in pregnant cows.

Through Fredericka's work, two diagnostic tests for *Salmonella* have been developed. The first is known as a loop-mediated isothermal amplification (LAMP) assay.

This uses a fluorescent dye to detect the DNA of any *Salmonella* species present (see Figure 2). This test can be completed in under 30 minutes, providing a robust indication of the type of bacteria present.

The second diagnostic test enables the detection of *Salmonellae* bacteria themselves rather than just their DNA. The principle behind this assay is based on the immune reaction of cattle to salmonellosis. The system uses antibodies to detect the *Salmonella* bacteria and is a useful diagnostic tool for veterinary practices.

The new tests will facilitate targeted treatment of salmonellosis in cattle, help to safeguard current antibiotics and reduce the rapid increase of antibiotic-resistant *Salmonella* species.

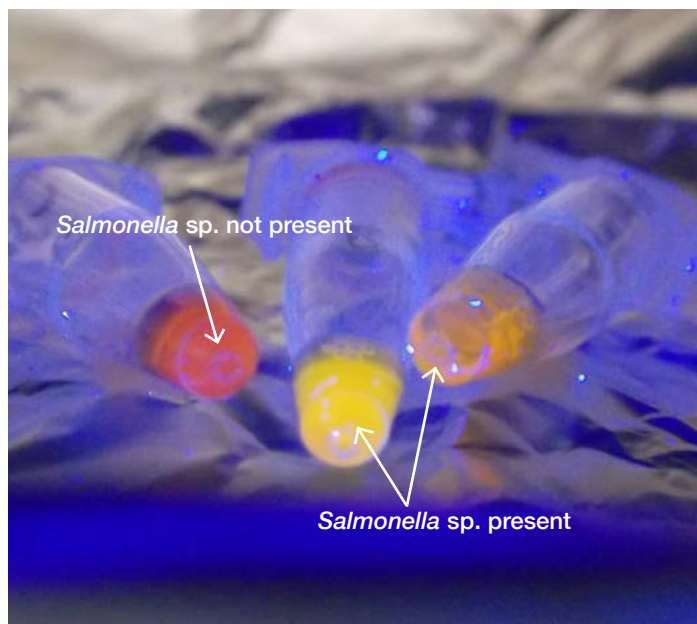


Figure 2. LAMP test tubes after 30 minutes under an ultraviolet light. A clear distinction can be seen in colour between samples containing *Salmonella* sp. and samples not containing *Salmonella* sp.

Liver fluke

Liver fluke (*Fasciola hepatica*) is a common parasite of cattle and sheep in the UK and infection can result in significant production losses. Tessa Walsh has been developing a pen-side test to diagnose infection.

The cost and time needed to run current diagnostic tests such as faecal egg counting and antibody detection enzyme-linked immunosorbent assays (ELISA) has meant that many farmers treat their animals without a specific diagnosis. This practice may contribute to the development of resistance to some flukicide products. A pen-side diagnostic test for fluke infection would be invaluable, making it possible to monitor exposure in herds or flocks and administer treatment only to infected individuals.

A prototype pen-side test has been developed to detect fluke infections in cattle and sheep on farm (Figure 3). The design of the test is based around lateral flow technology, the same technology used for the home pregnancy test. This type of test is ideal for use on farm, as it is easy to perform and results are normally obtained in about five minutes.

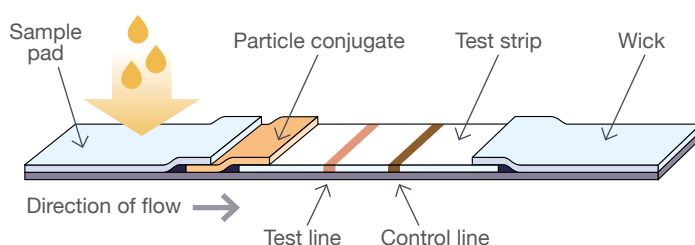


Figure 3. Prototype pen-side test for liver fluke using lateral flow technology

The test is easy to use on farm and based around same technology as home pregnancy tests.

Tested in the laboratory, using serum from animals known to carry infection, the pen-side test has been shown to work in approximately five minutes and can detect infection between two to four weeks after infection. The test is still in the prototype phase, with much validation needed before it is available for use on farm. Once validation in the lab and field trials is complete, the next step would aim to make this test commercially available.

Funded by AHDB Beef & Lamb.



Current projects

Selecting for feed efficiency

The Beef Feed Efficiency Programme is nearing the end of its four-year duration and is due to finish in December 2018. It will then have recorded the feed intake of 2,500 cattle at both a research farm at SRUC and on four commercial beef farms. These records identify feed-efficient cattle that eat less than others but grow at the same rate, demonstrating how feed efficiency traits can be measured and selected for beef cattle in a commercial environment. The project is measuring both Limousin and Angus-sired steers so the comparison between continental and native breeds can inform future analysis.

Being able to select for feed efficiency traits provides significant opportunities for beef farmers to cut the cost of production by reducing feed costs.

Interim results

As expected, results continue to show a range of feed efficiency between different sire groups. Figure 4 shows the comparison between daily liveweight gain (DLWG) and feed intake for two sire groups from one farm. The two red-circled animals exhibit very similar DLWG, but very different dry matter intake. The animal circled on the left is a much more efficient animal because it has gained the same amount of weight but taken in much less feed to do so.

Residual feed intake (RFI) is calculated as the difference between the expected intake and actual intake of an animal and is therefore expressed as a negative value for those animals who eat less than expected but grow at the same rate.

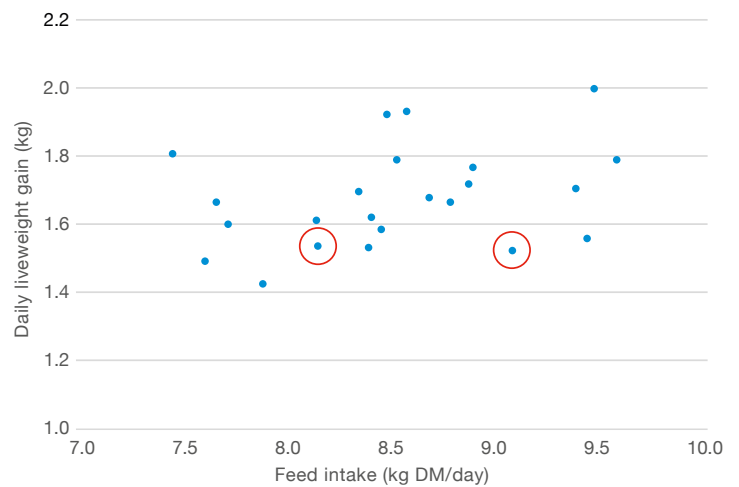


Figure 4. Feed intake and performance of cattle sired by two bulls from the same herd

Within the project, the most feed-efficient sire group ate, on average, 0.7kg DM per day less than expected, and 1.4kg DM per day less than the least efficient sire group which ate approximately 0.7kg DM more than expected.

The differences expressed by the sire groups in the commercial units are similar to those reported by studies from Alberta and Australia.

A group of beef supply chain stakeholders has been brought together to develop potential business models to deliver a self-sustaining national programme of breeding for feed efficiency in beef cattle, following the completion of the project. The group is investigating the possibility of working with existing supply chains to submit suitable cattle to the units for collection of feed efficiency data. Further work will involve advising on the development of national standards for feed intake recording in beef cattle and overseeing the knowledge exchange activity.

Funded by AHDB Beef & Lamb and Defra. The Scottish unit is funded by SRUC and the Scottish Government.



Breeding for parasite resistance in sheep

Gastrointestinal roundworm infection can have a significant impact on lamb production and, consequently, the financial viability of a farm business. The ability to select sheep that are more genetically resistant to roundworms is a useful tool to combat this health challenge.

Despite the low heritability associated with health traits such as parasite resistance, sufficient genetic variation exists within breeds for progress to be made through the use of EBVs, including a range of faecal egg count (FEC) EBVs that are currently available to Signet clients.

More recently, a new trait, saliva immunoglobulin A (IgA), has been included in routine Lleyn analyses.

Research at Glasgow University has shown that the antibody response against the larval stages of *Teladorsagia circumcincta*, an important member of the Strongyle family, can be used as a biological marker for host response to infection.

High levels of IgA in the saliva of sheep have been shown to regulate both worm growth and fecundity, leading to a decrease in egg output.

In 2013 and 2015, the Performance Recorded Lleyn Breeders (PRLB) group was awarded an AHDB Farm Innovation Grant to support the collection of FEC and IgA samples leading to the creation of the new saliva IgA EBV.

Lleyn breeders use both IgA and FEC EBVs when making breeding decisions. Breeders need to look for:

- Lower than average FEC EBVs – excrete less eggs
- Higher than average IgA EBVs – have more IgA and therefore reduced egg output

Future opportunities for sheep breed improvement

Defra has funded a scoping study, led by SRUC, to explore opportunities for productivity growth in sheep production through genetic improvement, delivered by the development of balanced breeding goals. The project will produce a business case for an integrated sheep genetic improvement network, bringing together academics and industry to address the productivity challenge.

The aim is to define breeding goals and strategies to help breeders meet future needs and to inform research needed to deliver these goals.

This will be addressed through two main work streams: definition of the appropriate breeding goals and economic analysis of consequences of implementing different breeding goals.

The breeding goals and strategies to be evaluated will be defined using literature review, structured stakeholder interviews and industry workshops. These goals are likely to be addressed on maternal upland, maternal lowland and terminal systems, with variations in the selection pressure put on different traits of economic importance, depending on the production system for which a breeding goal is created. At the end of the project, three breeding programmes will likely be defined with appropriate trait weightings agreed by consensus among all team and stakeholders.

The project team will examine, at a national level, economic consequences of applying the different breeding goals identified, using both genetic and economic modelling to evaluate the benefits and costs of selection under various scenarios.

This project aims to identify how a sheep genetic improvement network might be constituted to increase the rate of adoption of genetic improvement in sheep.

Responsible antibiotic use

Antibiotics are an important group of medicines used in both animal and human health management. They are currently attracting much interest because of widespread concern over the development of resistance.

As part of the government's response to tackle the issue of antibiotic use in the agriculture industry, the Responsible Use of Medicines in Agriculture (RUMA) alliance set up the Targets Task Force (TTF) in 2016, with the aim of providing sector-specific targets for the reduction, refinement or replacement of antibiotics in livestock production. The RUMA TTF report can be found at ruma.org.uk

Both the sheep and beef sectors are recognised as low users of antibiotics. However, with no new antibiotics on the horizon, there is an urgent need to preserve the effectiveness of these valuable medicines by ensuring they are used responsibly and when needed, to ensure the health and welfare of animals is maintained.

Cattle

AHDB has been actively involved in the Beef TTF, which is focusing on three key areas:

1. Establishing the baseline usage level of antibiotics in the beef sector, this will include reporting on the use of the highest critically important antibiotics and the use of vaccinations.
2. Developing a standard methodology for farm-level benchmarking of antibiotic use.
3. Promoting best practice and knowledge exchange to show farmers how others have been able to reduce antibiotic use and maintain high levels of animal health and performance. An industry campaign on calf health is planned for autumn 2018.

AHDB is playing a key role in delivering the beef targets, working with the Veterinary Medicines Directorate (VMD) and Farm Vet Systems to investigate the potential for

veterinary sales data to provide an indication of antibiotic use in the beef sector.

A pilot for an electronic medicine book for cattle is also planned, which will provide a way of collecting antibiotic use across the industry. The aim of this software is to provide a way to collect data that can feed into national sector-level reporting of use, while providing the facility to record medicine use on individual farms, enabling benchmarking locally within and between farms to share best practice.

The pilot will last six months and will develop a software programme that can accept medicine and cattle population records from a range of sources, including manual data entry and farm management software. The initial focus is on recording antibiotic use and will report usage in a number of different ways to help identify trends and peaks of use that need to be addressed on farm. Use of high-priority critically important antibiotics (HP-CIAs) will be highlighted throughout the reports.

Parallel work led by the University of Bristol will focus on the development of metrics that can be adopted by beef farmers to accurately assess, record and benchmark farm medicine use and be used as key performance indicators for individual enterprises as well as the industry as a whole.

Working with nine collaborators from academia, veterinary practices and the processing sector, this project will investigate the use of both veterinary prescription records and on-farm records from a number of beef farms for medicine benchmarking.

In addition, a PhD studentship at the University of Nottingham is furthering our work on understanding usage patterns and perception towards antibiotic use on beef and sheep farms. Another studentship at Nottingham University will focus on youngstock health, a key hotspot area of antibiotic use in beef systems.





Sheep

The RUMA taskforce set a target for the sheep industry to reduce antibiotic use by 10 per cent from 2016 to 2020. For HP-CIAs, which are important to human medicine, the target reduction is 50 per cent in the same period.

For the sheep industry, the focus for antibiotic reduction is on responsible use in three hot-spot areas: the control of lameness, the control of enzootic abortion and the control of disease in newborn lambs. AHDB is currently funding research projects to help increase our knowledge of antibiotic use in the sheep industry.

Three three-year PhD studentships at the University of Nottingham:

- Evidence-based farm decisions for lamb production, completing in September 2019
- A study to quantify usage patterns and understand perceptions towards antibiotic use on beef and sheep farms, completing in September 2020
- Optimising the use of footbathing for control and prevention of lameness in sheep, completing in September 2020

Three four-year PhD studentships at the University of Warwick:

- What really causes footrot in sheep, completing in September 2019
- *Dichelobacter nodosus* metapopulations and epidemiology of footrot in endemically infected flocks, completing in September 2019
- The role of lambs, time and space in persistence of *Dichelobacter nodosus*, the causal agent of footrot, completing in September 2021

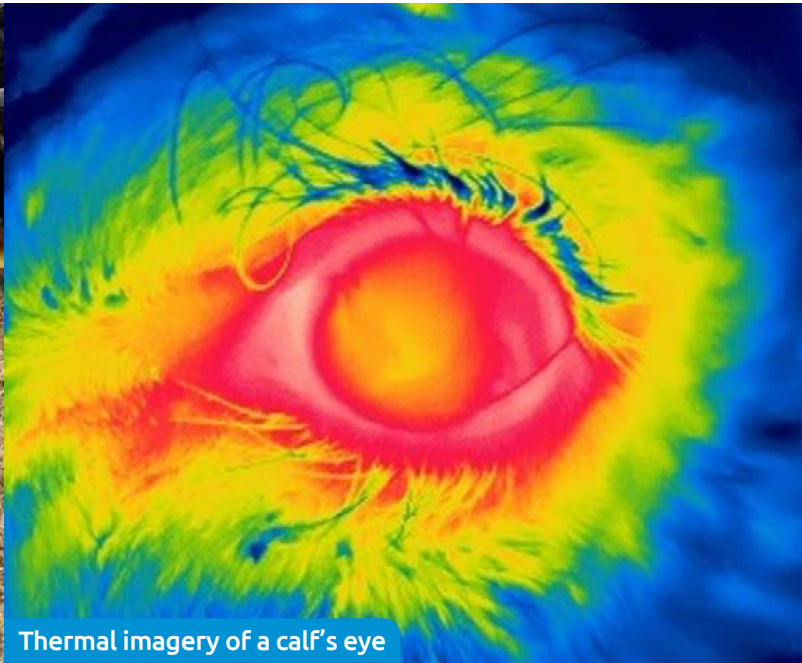
A four-year research project at the University of Liverpool, 'Unravelling the aetiology of contagious ovine digital dermatitis' completing in January 2020.

A two-year research project at the SRUC, 'tackling neonatal lamb losses' which completed in 2018.

In addition, under the leadership of the Sheep Health and Welfare Group (SHAWG), a consortium of leading sheep veterinary and sheep farming organisations, including AHDB, have come together to ensure a combined effort to communicate simple coordinated messages to the sheep industry. Timely and appropriate messages have been widely issued aimed at farmers, their vets, merchants and pharmaceutical companies involving meat processors and retailers.

For the three hot-spot areas, the group has been able to suggest that farmers and vets plan ahead, prevent disease occurring, for example with good hygiene and environmental conditions, and protect animals, for example through vaccination or adequate colostrum intake. These simple yet effective strategies reduce the use of antibiotics, while ensuring health and welfare needs of sheep and lambs are met. In addition, vets have been given support, resources and encouragement to set up Flock Health Clubs and conduct farmer meetings to help encourage good farmer-vet relationships.

“ Responsible use of medicines is about using as little as possible but as much as necessary ”



Thermal imagery of a calf's eye

Evaluating beef finishing units in England

Westpoint Veterinary Group and SAC Consulting are working to provide an evidence base for the level of cattle health and welfare in beef finishing systems in England. The aim is to identify innovations and best practice in order to maximise cattle health, welfare and performance on finishing units.

A review of published scientific literature considered evidence relating to beef finishing systems in temperate climates across the world. Choice of finishing system, age at slaughter, duration of finishing period, nutrition and feeding practice are just some of the management factors that interact to influence animal performance.

A survey of 32 beef finishing units with more than 200 finishing cattle places in England has been completed. This collected information on system type, management factors, housing design, health and welfare. It identified that a wide range of systems, management practices and cattle housing facilities are used.

A high level of animal health and welfare was reported on all units, which was evidenced by farmer-recorded health events and independent welfare assessments.

The literature review and survey have identified areas for further research to inform how best to manage finishing cattle. The work plan for this research has yet to be agreed but current ideas include:

- Providing an artificial light cycle in the finishing period
- Investigating the effect of group size and variability of animal weights
- Cost-benefit analysis of weighing cattle during the finishing period

Funded by AHDB Beef & Lamb.

Youngstock health activity

SRUC is investigating the use of a range of monitoring tools to aid early disease detection in calves and inform the development of alternative health management options.

So far, the project has tested a number of monitoring techniques that target different physiological functions including core body temperature, activity, feeding behaviour and feed intake. In each case, the equipment has been assessed against the stockman's assessment of visual symptoms and a full health score taken daily by trained technicians. The most promising techniques have been selected for use in commercial trials in partnership with Blade Farming Ltd and ABP Food Group. Calves from the commercial trials will be followed through to slaughter to assess the implications of disease in early life on lifelong production efficiency.

The technologies being tested, include:

- Automatic calf feeders: provide data on total milk intake per day and feeding behaviour traits
- Activity data from individual calves using leg-mounted sensors
- Thermal imagery to measure temperature at the inner corner of the eye to predict deep body temperature
- Temperature-sensing ear tags were fitted to each calf on entry to the group pens and removed at the start of weaning

During the project, huge amounts of data from each calf will be collected with the aim of finding the best early indicators of deteriorating calf health.

Funded by AHDB Beef & Lamb.



Beef parasite activity

AHDB Beef & Lamb is funding a number of projects addressing parasitic disease of beef cattle. Many of these, such as those focusing on liver and rumen fluke, are also applicable to sheep.

Liver fluke

Ongoing work led by the University of Liverpool, funded by BBSRC and all of the UK devolved red meat levy boards, continues to develop better advice for farmers around control of liver fluke infections. The project, spanning four years, is working to improve diagnostic techniques and identify management factors on farm that are associated with high fluke risk. Improving liver fluke diagnosis is also the objective of the work by PhD student Tessa Walsh described on page 13.

Rumen fluke

AHDB Beef & Lamb is collaborating with Queens University of Belfast and the Northern Irish Agri-Food and Biosciences Institute to address the emerging threat to animal health, welfare and livestock sustainability, posed by an increased incidence of rumen fluke (paramphistomes) in sheep and cattle.

This project will provide a better understanding of the spread and biology of rumen fluke infection in the UK, and produce the necessary tools for its rapid diagnosis. Such knowledge will provide the platform on which practically applicable control strategies can be based.

Farmers are often not aware of the presence of rumen fluke or whether it is advisable to treat the infection.

The project aims to address the following questions:

1. What is the extent of the rumen fluke problem in the UK?
2. What is the impact of rumen fluke on animal performance, health and welfare?
3. Can we develop a rapid and specific diagnostic test for rumen fluke?

Work is well underway on the development of diagnostic tests using faecal samples and bulk milk. On-farm work is evaluating the impact of rumen fluke infection on diarrhoea scores and growth rates of grazing dairy heifers and feed intake, and digestibility in sheep.

Cryptosporidiosis

Hannah Shaw is completing an AHDB Beef & Lamb-funded PhD at Moredun Research Institute developing improved control strategies for Cryptosporidiosis in calves and gaining better understanding of its impact on farm.

Cryptosporidiosis is caused by a zoonotic parasite called *Cryptosporidium* and is a major cause of enteritis and death in neonatal calves in the UK. Initial results from Hannah's work have shown that suckled calves with severe clinical disease weigh, on average, 38kg less at six months of age than those with no clinical signs of the disease (Figure 5). Calves with severe clinical symptoms showed reduced growth rates throughout their rearing phase to weaning.

Hannah's work is also investigating routes of transmission from adult cattle and the environment and the long-term impact of *Cryptosporidium* infection in beef calves.

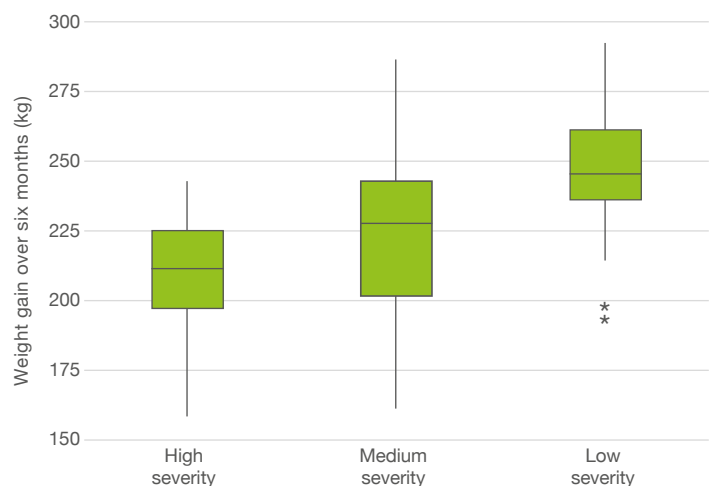


Figure 5. Weight gain of calves versus cryptosporidiosis severity

Increasing expertise in pathology

In February 2017, AHDB Beef & Lamb and MSD Animal Health funded a three-year pathology scholarship, which was awarded to Katie Waine. The scholarship is being used to:

- Ensure farm animal pathology expertise continues to exist
- Create a sustainable training course for future farm animal pathologists
- Support farm animal veterinary surgeons in their disease diagnosis and post-mortem skills
- Ensure efficient and economical on-farm post-mortems benefit the farmer
- Provide information to the farmer, allowing delivery of timely treatment and preventative measures

This approach is helping to fill the shortage of farm animal pathologists.

Part of Katie's scholarship involves working with Ben Strugnell of Farm Post Mortems Ltd. and using the data they gather to help farmers make informed decisions. The 10 most frequent diagnoses made in 154 submissions of lambs from September to November 2017 are given in Figure 6.

This data highlights the importance of correct vaccination and medicine use.

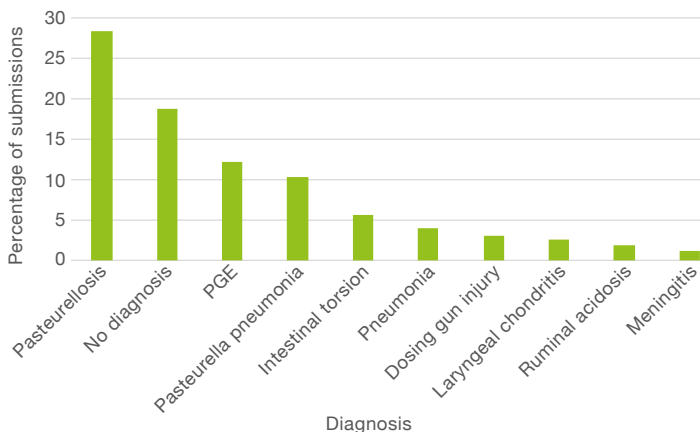


Figure 6. The ten most frequent diagnoses made in 154 submissions of lambs from September to November 2017
PGE = Parasitic gastroenteritis

Improving understanding of laryngeal chondritis

As part of Katie's scholarship she is doing some work on laryngeal chondritis (Texel throat) in a bid to improve the understanding of the condition. Laryngeal chondritis is a severe upper respiratory tract disease of sheep, the cause of which is unknown.

The level of the disease in the UK and internationally is not known, but it is mainly thought to affect young rams and predominantly the Texel and Beltex breeds. The disease has health and welfare implications for the individual sheep affected, as well as economic consequences for the farm.

The condition may have a genetic basis but it is unclear what traits cause certain breeds of sheep to be more prone to it. Previous work suggests that the anatomy of the head and neck in the well-muscled breeds may have affected the structure of the larynx, making them more susceptible to the condition.

The anatomy of the larynx will be examined and compared from 30 unaffected Bluefaced Leicester rams (Figure 7) and 30 Texel rams (Figure 8) collected from fallen stock centres.

The larynges are dissected, measured and photographed to try to determine if and how the anatomy may differ. CT images are also being collected to assess the shape and size of the airway through the larynx.



Figure 7. Anatomy of larynx from a Bluefaced Leicester ram

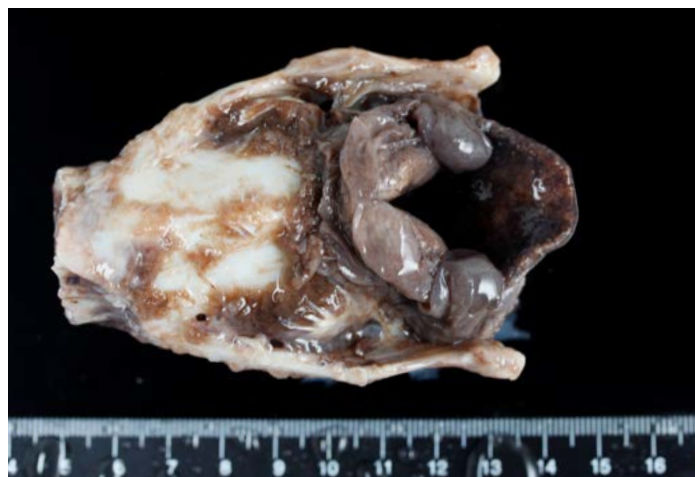


Figure 8. Anatomy of larynx from a Texel ram

Reviewing chronic wasting diseases in sheep

Chronic wasting diseases in sheep not only impact the health and welfare of affected animals and their lambs, but also substantially reduce the profitability, sustainability and resilience of the sheep industry.

The five diseases are:

- Border disease (BD)
- Caseous Lymphadenitis (CLA)
- Johne's disease (OJD)
- Maedi Visna (MV)
- Ovine Pulmonary Adenomatosis (OPA)

The five chronic wasting diseases carry common features in that they are production-limiting and infected sheep are not obviously ill.

Within a flock there may be a few infected sheep, some of which will show no visible symptoms of disease. The extent of the problem within a flock can be underestimated because visibly diseased sheep are usually just the tip of the iceberg, which is why these diseases are sometimes referred to as 'iceberg' diseases. As a consequence, their importance is often overlooked until a flock's productivity is substantially reduced.

Currently, there is little information available within the UK on how to effectively tackle iceberg diseases. Existing sheep health schemes, such as the Maedi Visna (MV) accreditation run by the Premium Sheep Goat and Health Scheme (PSGHS), currently rely on obtaining a market premium for accredited stock. While there is evidence

that these health schemes work, they are often criticised for being too expensive, inflexible and not cost-effective for commercial flocks. Indeed, the uptake of MV accreditation by pedigree flocks is good, but low for commercial flocks. The risk of a rapid rise of MV in 'open' non-participating commercial flocks is high unless joined-up and determined action is taken to prevent it.

A project at the University of Nottingham has been reviewing research on these five key chronic wasting diseases to produce a clear summary of action points and priorities for the UK sheep industry.

In terms of testing, there are commercial diagnostic tests available on live animals for all except OPA and vaccines are available for CLA and OJD. The existing tests are extremely valuable but their accuracy is lower than ideal and, occasionally, the tests provide incorrect results which, coupled with lack of awareness, reduces confidence in testing. The lack of knowledge means there isn't a programme to follow when a positive diagnostic test result is returned.

A literature review has been carried out to identify research gaps, and the team is analysing UK diagnostic and surveillance data from Animal and Plant Health Agency (APHA) and SRUC. The identification of research gaps will inform future R&D funding.

Three training courses for farm animal vets have been held to raise awareness and confidence in dealing with these diseases. The outcomes of this work will also include studies of production impact and provide a production impact decision tool and a test interpreter decision support tool. Other knowledge exchange activity will include a technical manual produced by AHDB Beef & Lamb, along with case studies, articles and webinars for farmers and vets.



Feed into Beef

An industry workshop in 2014 identified a need to update the existing beef cattle feeding systems guidance (AFRC, 1993). Much of the evidence underpinning the existing advice was taken from work in the 1970s and 1980s and, since then, both beef production systems and beef genetics have changed considerably. Evidence suggests that the current guidance underestimates nutrient requirements in a number of scenarios.

Various funding models were explored and, following an AHDB call for work in this area, a project led by the Centre of Innovation and Excellence in Livestock (CIEL), in partnership with SRUC and the Agri-Food and Biosciences Institute (AFBI), was commissioned in 2018.

As well as reviewing work from around the world and considering the pros and cons of the various nutrient models that exist globally, the project will also consider the environmental impact of beef production systems in terms of greenhouse gas emissions.

Specific areas of development include:

- Modelling feed intake – new equations providing improved predictions of feed intake for the main types of animals and diets will be developed
- Enhancing models for energy and protein requirements – recent work in France and the US, as well as in the UK, will provide key inputs to updating these models
- Improving the modelling of growth and carcass composition – understanding the response to nutrients in terms of performance and body composition will enable more targeted rationing to meet system requirements

- Updating and expanding tables of feed values – this will update current feed values and fill gaps that exist for new feeds
- Modelling feed interactions – recognition that the value of a feed changes according to the overall diet fed means understanding that interactions between feeds is important

The project will set up an industry advisory group including nutritionists and farmers to capture existing knowledge and experience and also to ensure that outcomes of the project are widely and effectively communicated to industry.

Knowledge exchange is an important element of the project. Links have already been made with scientists in other centres of expertise on beef nutrition around the world. This will ensure the project builds on the latest knowledge and avoids duplication. The team will engage with a range of different stakeholders to exchange ideas about how the current system can be upgraded to deliver improvements on farm. Once developed and tested, the new models will be rolled out to industry through a series of training sessions targeting different audiences within the sector.

While still in the early stages of its six-year duration, this project has been shaped to bring together industry, academic and commercial players across the beef industry to deliver a nutrition model that will enable beef farmers to increase feed efficiency, and reduce the feed cost and environmental impact of beef production.

Majority of the funding provided by AHDB Beef & Lamb, with industry partners also contributing funding and expertise.



Beef in arable rotations

This project will investigate the practical, economic, environmental and agronomic implications of integrating beef enterprises into arable systems, taking into account both the arable and beef farmers' perspective.

Objectives:

- To assess the physical and financial performance of growing cattle grazing arable grass leys
- To provide arable farmers with a cost-benefit evaluation of integrating grazed grass/herbal leys into the arable rotation
- Assess the impact of a three-year grass/herbal ley on soil structural and nutrient-retention properties, weed populations and subsequent crop yield

Pilot work on a farm in Cambridge showed there is potential for the arable farmer to make a margin from cattle grazing a temporary ley. For other farms, the economics will vary depending on the length of the ley and performance of the field while down to a ley. From the beef farmer's point of view, there is potential to reduce the cost of production, particularly fixed costs such as labour and machinery.

More detailed work is underway to follow the establishment of two types of grass ley into an arable rotation on a different farm. The seed mixtures were either a grass/clover ley or a similar ley containing herbal species such as plantain and Bird's-foot trefoil. These leys will be in place for three years, during which time herbage samples will be collected and cattle performance recorded, after which the fields will go back into the arable rotation and the effect on the following crop monitored.

Outdoor dairy beef

The feasibility of growing and finishing Hereford x Holstein-Friesian and pure-bred Holstein-Friesian autumn-born steers is being investigated at Harper

Adams University. The study will use predominantly grass and fodder beet, with minimal reliance on cereals or other bought-in concentrates, apart from the initial rearing of the calf.

The aim is to develop a low-cost intensive grass and forage-based system which will maximise stocking rates through the use of rotational grazing and overwintering on fodder beet. The target slaughter age is 20–21 months of age, thereby avoiding the need for the steers to be kept for a second winter and finished inside.

The cattle will finish during the summer 2018 with full results available later that year. The project will include a financial appraisal of the system as well as report on cattle performance, health and carcass quality.

Table 4. Cattle performance targets over project lifetime

	kg	kg/day
Liveweight of reared calf at end of 3 months' rearing period	120	
Liveweight at turnout in March	180	
Target DLWG at grass		>1.0
Liveweight at end of October	370	
Target DLWG on fodder beet		>0.7
Liveweight at end February	460	
Target DLWG at grass during second grazing season		1.3
Liveweight at slaughter	620	
Hereford x Friesian carcass weight @ 53.5% KO grading O+/R 3/4L	335	
Holstein carcass weight @ 50.5% KO grading P+/-O 2/3	315	

This project is led by ADAS, funded by AHDB Beef & Lamb and supported by Harper Adams University, the Hereford Cattle Society and Dunbia.





Launch meeting of grass and herbal ley network

Enhancing soil biology and improving soil health

This five-year Soil Biology and Soil Health Partnership is a cross-sector programme of research and knowledge exchange. The programme is designed to help farmers and growers maintain and improve the productivity of UK agricultural and horticultural systems, through better understanding of soil biology and soil health.

The project will improve industry knowledge on the benefits of using grass leys within arable rotations. Some of the long-standing rotation experiments that are being reviewed within the project contain grass leys, so their impact on future crops can be assessed. A significant amount of work has already been carried out and the aim is to translate as much of this as possible into knowledge exchange materials.

Up to eight farmer research innovation groups are being set up, with some of those groups investigating the impact of grazing livestock on grass leys and cover crops has on future crop yields and will link to the grass and herbal ley network. Over the next three years, these groups will be responsible for testing and validating the 'soil health scorecard' on farm, across a range of production systems and soil types.

The soil health scorecard is a key outcome of this project and will help farmers and growers quantify soil health and any changes after alterations to management practices.

Some elements of the project have already finished and the reports can be found at ahdb.org.uk/projects/greatsoils.aspx A range of resources from across AHDB is also available on this website.

Funded by AHDB and BBRO

Grass and herbal leys network

The government's 25-year environment plan lists improving soil health as a priority. Arable cropping with annual cultivations and little or no organic material input will reduce soil organic matter (SOM) content and affect soil health. Using grass and herbal leys within an arable rotation can help overcome these challenges, and benefits both livestock and arable farmers.

AHDB and Defra are supporting ADAS in the establishment of a network for farmers, researchers and industry representatives to investigate the long-term benefits of grass and herbal leys within arable rotations.

The network will:

1. Look at the changes in SOM and soil health, where grass and herbal leys are used.
2. Explore how the SOM and soil health change after the land has returned to arable cropping.
3. Investigate the effectiveness of grass and herbal leys in controlling blackgrass.

Over 80 people attended the launch meeting in April 2018. It included a scientific session on the rotational benefits of grass and herbal leys, and a panel session discussing practical issues of managing leys within rotation. A survey of farmers, industry representatives and researchers has been completed to develop priorities for the network.

Feedback from the survey and the launch meeting will be used to shape the network's aims and identify research opportunities. A regular exchange of experiences will be encouraged to ensure farmers and researchers are learning from others.



Challenge Sheep

Challenge Sheep aims to understand the consequences of the rearing phase on the lifetime performance of ewes. Covering sheep bred both as ewe lambs and shearlings, the project will track 9,500 replacements from a range of English sheep farms over seven years to understand how flock performance can be improved. The project aims to generate new knowledge and highlight existing information on managing ewe replacements. The cost benefits of different management techniques and interventions will be investigated using Farmbench.

Twelve producers are taking part in Challenge Sheep and have been selected to cover a range of systems. These farms are located from Northumberland to Devon and are divided between those lambing ewe lambs or shearlings for the first time, outdoor and indoor systems and a range of breeds. From the ewes first tupping, farmers taking part in Challenge Sheep will be required to collect data via electronic identification (EID), including weights, body condition score, lambing data and lamb performance, at five key points during the year.



They will also be involved in several events over the seven years and in three discussion groups per year, where findings will be communicated to other farmers. Project farms will receive regular feedback and help with monitoring changes to their business.

For more information, see beefandlamb.ahdb.org.uk/returns/project-farms

Funded by AHDB Beef & Lamb.

Farmbench in research projects

AHDB's Farmbench system allows farmers to input either whole farm or enterprise-specific data to suit their needs. Costs can be split across beef, sheep, potato and arable enterprises, with dairy coming online in 2018.

Farmbench can help manage resilience to risks and coping with volatility. The agriculture industry is likely to experience significantly greater exposure to fluctuating prices, currency swings and adverse climatic events, impacting the resilience of many farm businesses. Farmbench also allows farmers to pitch themselves against other businesses to see how they are competing.

The system is being used by project farms such as those taking part in Challenge Sheep, as well as Beef & Lamb Strategic farms, which are part of AHDB's wider Farm Excellence network. Within a project, Farmbench enables the setting and monitoring of targets to improve efficiencies. It also provides a tool to measure the outcome of different management systems that are being tested, to help show what works and what doesn't on different farms.

For more information on Farmbench, see farmbench.ahdb.org.uk

Other projects

Title	Why	Institution	Species		Area					Completion date
			Beef	Sheep	Health & Welfare	Nutrition	Genetics	Meat Quality	Systems	
Feed planning tool development	To understand how to develop a feed planning tool for UK systems	Farmax	✓	✓					✓	Nov 17
Feed into Lamb	To check current energy requirements for ewes	AFBI		✓		✓				Dec 18
SUREROOT	To understand grass and clover root interactions for crop production and soil structure	Aberystwyth	✓	✓		✓	✓			Mar 19
Sustainable Agricultural Research and Innovation Club (SARIC)	Supports innovative projects that improve the efficiency, productivity and sustainability of UK crop and livestock sectors	Various	✓	✓	✓	✓	✓		✓	Mar 19
Do suckler calves absorb enough antibodies from colostrum?	How to improve passive transfer of immunity in suckler calves	University of Edinburgh	✓		✓					Mar 19
Best practice dairy beef rearing	To develop guidelines for rearers of beef cross animals from the dairy herd	Royal Agricultural University	✓		✓				✓	May 19
bTB evaluations in beef cattle	To evaluate if an EBV for resistance to TB, like TB Advantage in the dairy industry	SRUC	✓		✓		✓			Nov 19
iSAGE	Enhancing the sustainability, competitiveness and resilience of the European sheep and goat sectors	32 partners		✓	✓	✓	✓	✓	✓	Mar 20
Protein and mixed forage beef	Evaluating alternative protein sources and forages for growing and finishing beef diets	Harper Adams University	✓			✓				May 22
Recommended Grass and Clover Lists (RGCL)	To update and promote the RGCL annually	BSPB	✓	✓		✓				Mar 23

Studentships

Generally, AHDB Beef & Lamb fund three PhDs a year. However, when other sources of funding are available, such as CASE studentships, then AHDB Beef & Lamb can be involved in more. Some of the studentships are joint funded with AHDB Dairy. More details on the annual studentship call can be found on page 29.

Who	What		When	Where	Additional Funding
Jennifer McIntyre	Markers of anthelmintic resistance in gastro-intestinal parasites of ruminants	Beef and sheep	Oct 15 – Sep 18	Glasgow	KTN, (i)CASE
Hannah Shaw	Control of cryptosporidiosis in calves	Beef	Oct 15 – Sep 18	Moredun	AHDB Dairy
Grace Cuthill	Diagnosis of fluke infective stages in the environment	Beef and sheep	Oct 15 – Sep 18	Moredun	
Graham McAuliffe	Intensive pastoral production systems for beef – impact and value	Beef	Oct 15 – Sep 18	Bristol	Bristol, QMS
Lynsey Melville	Development of molecular tools for the rapid assessment of benzimidazole resistance and investigation of possible factors in resistance development in <i>Nematodirus</i>	Sheep	Jan 15 – Dec 18	Moredun	
Louise Whatford	Best practice to minimise mastitis in sheep	Sheep	Oct 15 – Dec 18	Warwick	
Naomi Prosser	What really causes footrot in sheep	Sheep	Oct 15 – Dec 18	Warwick	BBSRC, (i)CASE
Hanne Nijs	Developing an efficient, validated, sustainable on-farm syndromic surveillance system for beef cattle and sheep	Beef and sheep	Jan 16 – Sep 19	Warwick	Warwick
Zoe Willis	<i>Dichelobacter nodosus</i> metapopulations and epidemiology of footrot in endemically infected flocks	Sheep	Oct 15 – Sep 19	Warwick	KTN, (i)CASE
Elaina Lima	Evidence-based farm decisions for lamb production	Sheep	Oct 16 – Sep 19	Nottingham	
Scott Jones	The impact of Maedi Visna on breeding flocks	Sheep	Oct 16 – Sep 19	Nottingham	
Sophie Tyner	Reviewing beef nutritional standards	Beef	Oct 16 – Sep 19	AFBI	Agrisearch
Nerys Wright	Strategic use of body condition scoring to improve performance in commercial sheep flocks (part time)	Sheep	Jul 14 – Jun 20	Nottingham	

Studentships (continued)

Who	What	Species	When	Where	Additional Funding
Kate Bamford	Persistence and transmission of intramammary pathogens causing acute mastitis: the role of chronic intra-mammary abscesses	Sheep	Oct 16 – Sep 20	Warwick	BBSRC, DTP
Bethan John	Defining the genetic diversity of free living and intra-molluscan stages of <i>Fasciola hepatica</i>	Beef and sheep	Oct 16 – Sep 20	Liverpool	BBSRC, DTP
Hayley Marshall	Optimising the use of footbathing for control and prevention of lameness in sheep	Sheep	Oct 17 – Sep 20	Nottingham	
Charlotte Doidge	A study to quantify usage patterns and understand perceptions towards antimicrobial use on beef and sheep farms	Beef and sheep	Oct 17 – Sep 20	Nottingham	
Amy Smart	Development of novel technology (bio sensors) for rapid analysis of fatty acid composition in meat from pig and cattle	Beef	Oct 17 – Sep 20	University of West England	
Andy Jones	System-wide evaluation of pasture-based sheep production – impact and value	Sheep	Oct 17 – Sep 20	Bristol	
Katherine Lewis	The role of lambs, time and space in persistence of <i>Dichelobacter nodosus</i> , the causal agent of footrot	Sheep	Oct 17 – Sep 21	Warwick	BBSRC, DTP

Upcoming PhDs

Four new PhDs will start in October 2018.

What	Species	When	Where	Additional Funding
Achieving world class livestock enterprises in a post-Brexit world	Beef and sheep	Oct 18 – Sep 21	Nottingham	
Optimising the health and welfare of dairy and dairy cross-bred calves	Beef	Oct 18 – Sep 21	Nottingham	AHDB Dairy, AFCP
System-wide evaluation of pasture-based sheep production systems based on high-resolution primary data	Sheep	Oct 18 – Sep 22	Bristol	BBSRC, DTP
Epidemiological studies into the role of serogroup-specific vaccines to control footrot in sheep	Sheep	Oct 18 – Sep 22	Birmingham	BBSRC, DTP

R&D process

R&D is managed by the AHDB technical staff team, in consultation with the research and knowledge exchange (RKE) committee.

Project proposals can come to AHDB in response to a tender (specific area) or a call (more general area), or as unsolicited proposals. Applicants who are submitting unsolicited proposals are encouraged to discuss them with AHDB staff prior to submission to ensure the subject is appropriate and to prevent unnecessary work.

Proposals are submitted on the appropriate template and reviewed by staff, including testing the investment based on its cost benefit and fit with AHDB strategy, before going to the Beef & Lamb RKE committee. The committee meets six times a year and any proposal needs to be received by the technical team around two months prior to the meeting to allow time for review. Proposals may be subjected to peer review if additional expert opinion is needed.

The RKE committee can recommend funding (subject to contract), request revision and resubmission or can reject the proposal. The applicant will be informed and a technical team member will work with them, as appropriate. If the proposal is successful, a contract will be signed and then the work can begin.

AHDB works closely with HCC, QMS and AgriSearch through a collaborative committee of staff representing the UK red meat levy organisations.

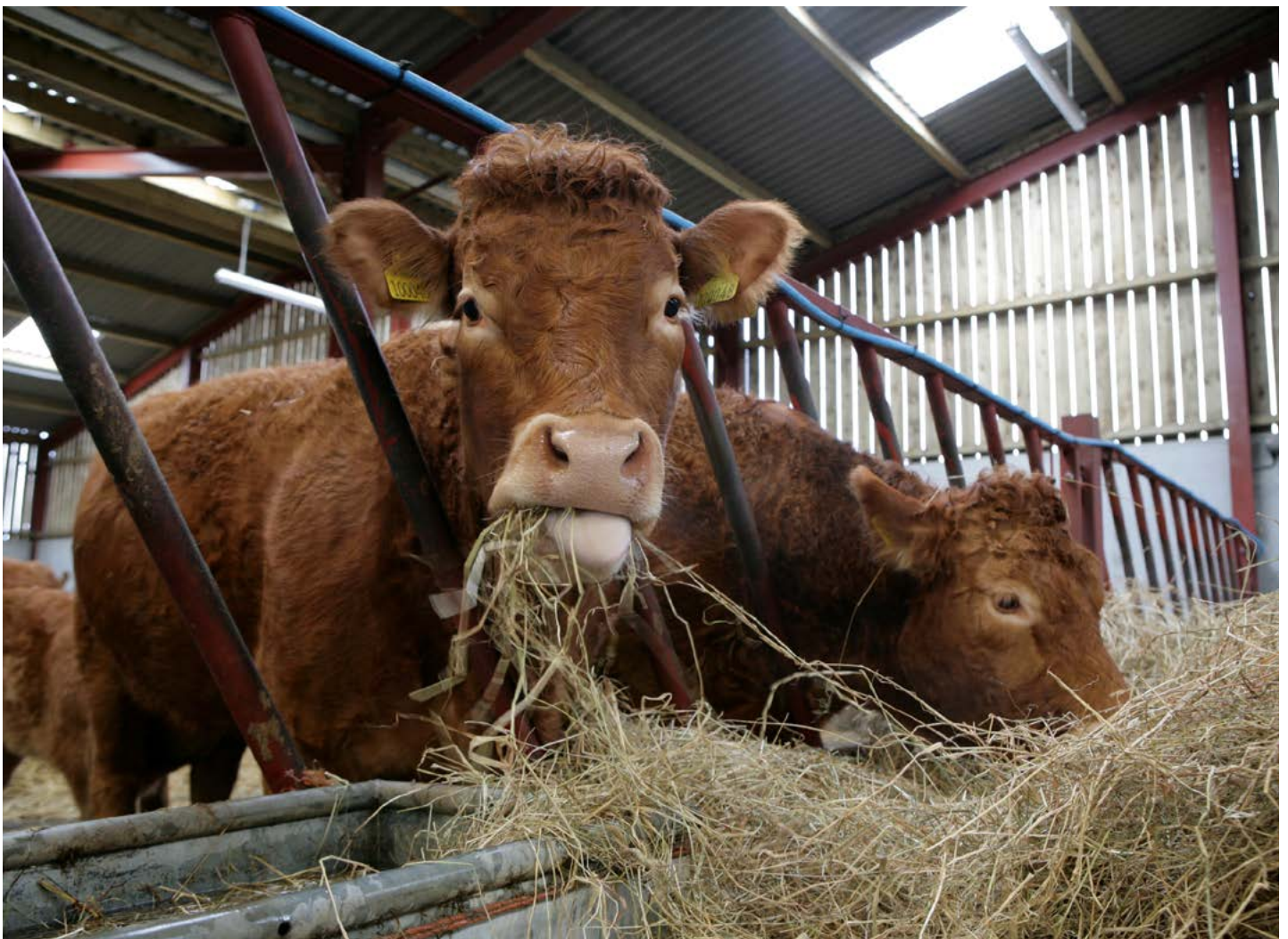
This group has quarterly teleconferences or meetings to discuss joint projects or ideas, with the aim of one face-to-face meeting a year. This is aimed at avoiding duplication and maximising co-funding opportunities.

Studentships

Across all six sectors, AHDB generally funds fifteen PhD studentships a year and issues a call for PhD studentships in early summer for a deadline in September. Applicants are expected to demonstrate that their proposals meet the priorities of at least one of the AHDB sector divisions participating in the programme.

The successful applicants are informed in January and the supervisor is expected to recruit a student, generally to start in October.

AHDB has an annual studentship seminar where all PhD students present their work. It provides a good opportunity to gain experience of presenting and builds their awareness of other projects AHDB is funding.



Glossary

AFBI	Agri-Food and Biosciences Institute of Northern Ireland	(i)CASE	(industrial) Collaborative Awards in Science and Engineering
AFCP	AgriFood Charities Partnership	IgA	Immunoglobulin A
AFRC	Agriculture and Food Research Council	KE	Knowledge exchange
AHDB	Agriculture and Horticulture Development Board	KTN	Knowledge Transfer Network
APHA	Animal and Plant Health Agency	LAMP	Loop-mediated isothermal amplification
BBRO	British Beet Research Organisation	LSU	Livestock units
BBSRC	Biotechnology and Biological Sciences Research Council	ME	Metabolisable energy
BCS	Body condition score	MLA	Meat & Livestock Australia
BD	Border disease	MSA	Meat Standards Australia
BRP	Better Returns Programme	MV	Maedi Visna
CHeCs	Cattle Health Certification Standards	NERC	Natural Environment Research Council
CIEL	Centre of Innovation Excellence in Livestock	OJD	Johne's disease
CLA	Caseous Lymphadenitis	OPA	Ovine Pulmonary Adenomatosis
CODD	Contagious ovine digital dermatitis	PGE	Parasitic gastroenteritis
CPD	Continuous professional development	PRLB	Performance Recorded Lleyn Breeders Group
CT	Computed tomography	PSGHS	Premium Sheep Goat and Health Scheme
DM	Dry matter	QMS	Quality Meat Scotland
DLWG	Daily liveweight gain	R&D	Research and development
DTP	Doctorate Training Partnerships	RKE	Research and knowledge exchange
EBV	Estimated Breeding Values	RFI	Residual feed intake
EID	Electronic identification	RUMA	Responsible Use of Medicines in Agriculture
ELISA	Enzyme-linked immunosorbent assay	SHAWG	Sheep Health and Welfare Group
FEC	Faecal egg count	SOM	Soil organic matter
FYM	Farm yard manure	SRUC	Scotland's Rural Colleague
HCC	Hybu Cig Cymru (Meat Promotion Wales)	TTF	Target task force
HP-CIA	High priority critically important antibiotics	VMD	Veterinary Medicines Directorate



Meet the team



Kim Matthews

Head of Animal Breeding & Product Quality

T 024 7647 8824

E kim.matthews@ahdb.org.uk

Areas of interest: Meat science, Genetics



Dr Lis King

Sheep Scientist

T 07741 077244

E lis.king@ahdb.org.uk

Areas of interest: Sheep health, Sheep welfare, Sheep performance, Lameness



Ray Keatinge

Head of Animal Science

T 024 7647 8687

E ray.keatinge@ahdb.org.uk

Areas of interest: Dairy production, Use of data in farming systems, Precision agriculture



Samuel Boon

Animal Breeding Senior Manager - Signet

T 024 7647 8826

E samuel.boon@ahdb.org.uk

Areas of interest: Sheep breeding, Beef breeding, Pedigree marketing



Dr Mary Vickers

Beef & Lamb Senior Scientist

T 07990 506012

E mary.vickers@ahdb.org.uk

Areas of interest: Beef production systems, Beef health, Beef nutrition, Environmental impact



Emma Steele

Signet Breeding Specialist Adviser

T 024 7647 8721

E emma.steele@ahdb.org.uk

Areas of interest: Sheep breeding, Beef breeding, Pedigree marketing



Dr Liz Genever

Beef & Lamb Senior Scientist

T 07790 378349

E liz.genever@ahdb.org.uk

Areas of interest: Sheep production, Sheep health, Sheep breeding, Grass and forage management



Siobhan Slayven

Supply Chain Development Manager

T 07391 415733

E siobhan.slayven@ahdb.org.uk

Areas of interest: Meat science, carcass and meat quality



Karen Morris

Livestock Science Team Coordinator

T 024 7647 8828

E karen.morris@ahdb.org.uk

Areas of interest: Contracts, Invoices, Committee papers, Studentships



Produced for you by:

AHDB Beef & Lamb

Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

T 024 7669 2051

E comms@ahdb.org.uk

W beefandlamb.ahdb.org.uk

 [@AHDB_BeefLamb](https://twitter.com/AHDB_BeefLamb)

If you no longer wish to receive this information, please email us on comms@ahdb.org.uk

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law, the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

© Agriculture and Horticulture Development Board 2018.

All rights reserved.

