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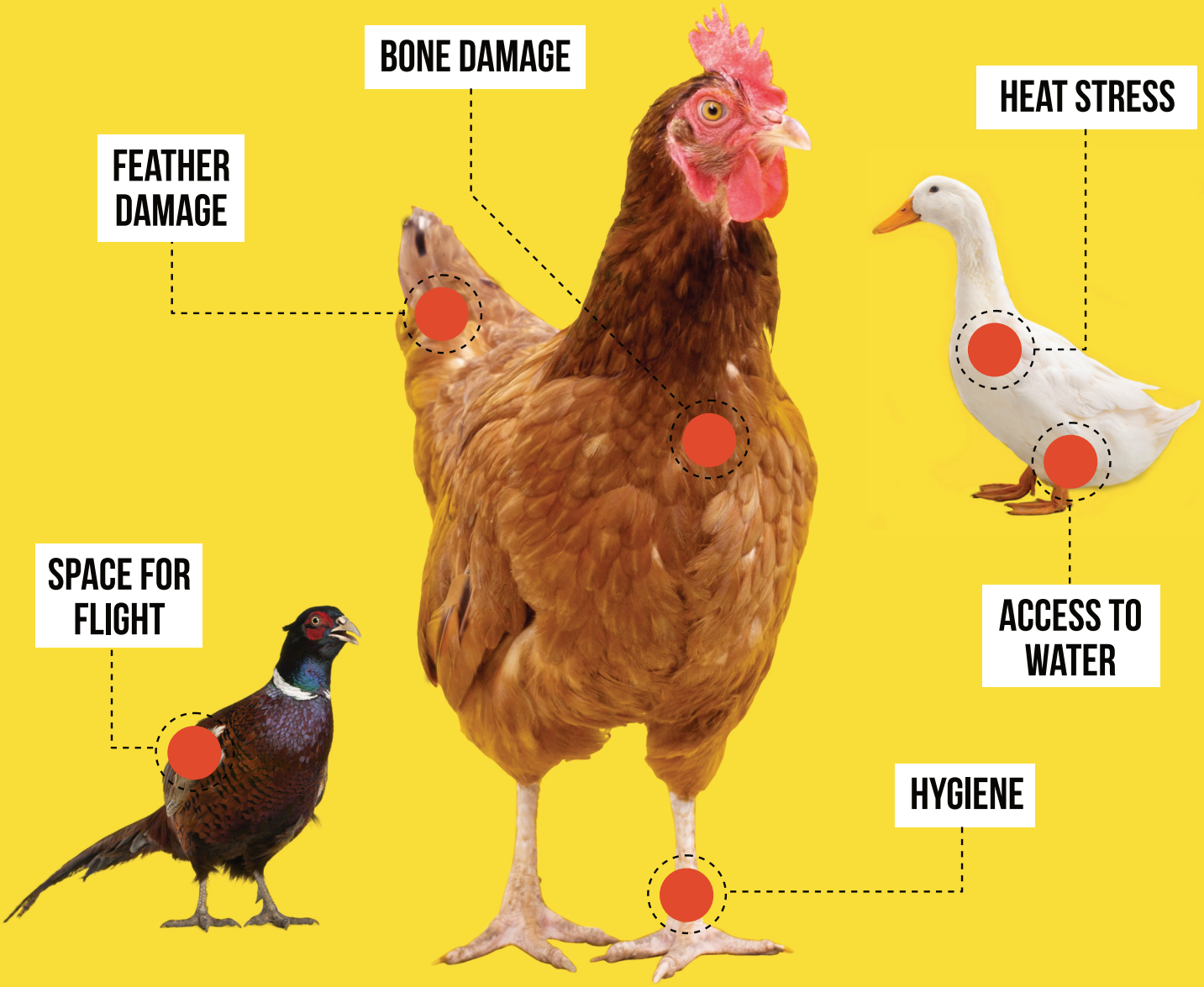
Issue #77 | July 2018

Poultry Digital



Keel bone damage: recent studies into flock welfare

The latest in poultry welfare across the globe

Inside the Welfare issue | Keel bone damage raises welfare concerns • A fairer prospect for waterfowl: a progress report on three top issues • Getting to the bottom of the pile: solving the mystery of piling behaviour • Why water access is the secret to duck health • Corn vs wheat: which diet results in happier, healthier quails? • Making life pleasant for pheasants • What will Brexit mean for the British game sector? • Q&A with Lisa Beohm: a case study in human welfare • Reader Q&A with Mike Colley

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FROM THE EDITOR

“Welfare: a big issue for a big issue”

This edition of *Poultry Digital Magazine* looks at the welfare of multiple species – a big issue for a big issue. We’ve even looked at human welfare (page 16), whose social sustainability is often not considered in discussions of animal and environmental protection.

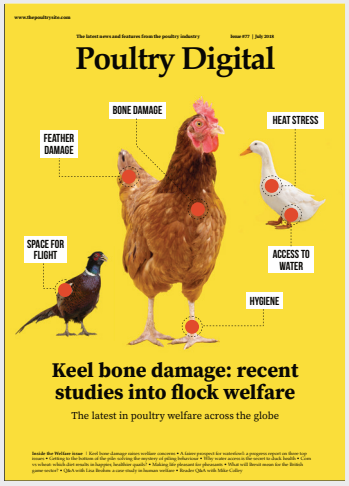
Join us to learn how keel bone damage was studied in relation to productivity and mobility (page 10), and to get an update on recent research into piling behaviour and its associated welfare concerns (page 21). We also take a fresh look at global goose (page 12) and duck welfare (page 24), as well as how feed type might impact quails during transportation in terms of stress.

By the way, how’s Brexit going to affect the welfare of pheasants on farms and grouse on moors? Especially considering so much of the UK’s pheasant population is imported as eggs or day-olds from France (page 30). Read on to find out, and join us again in September for our special issue on “Poultry Heroes” – people who are changing the way we think about and raise poultry.

Thanks always for reading,

Ryan Johnson | Editor

Poultry Digital Magazine
#77 | July 2018



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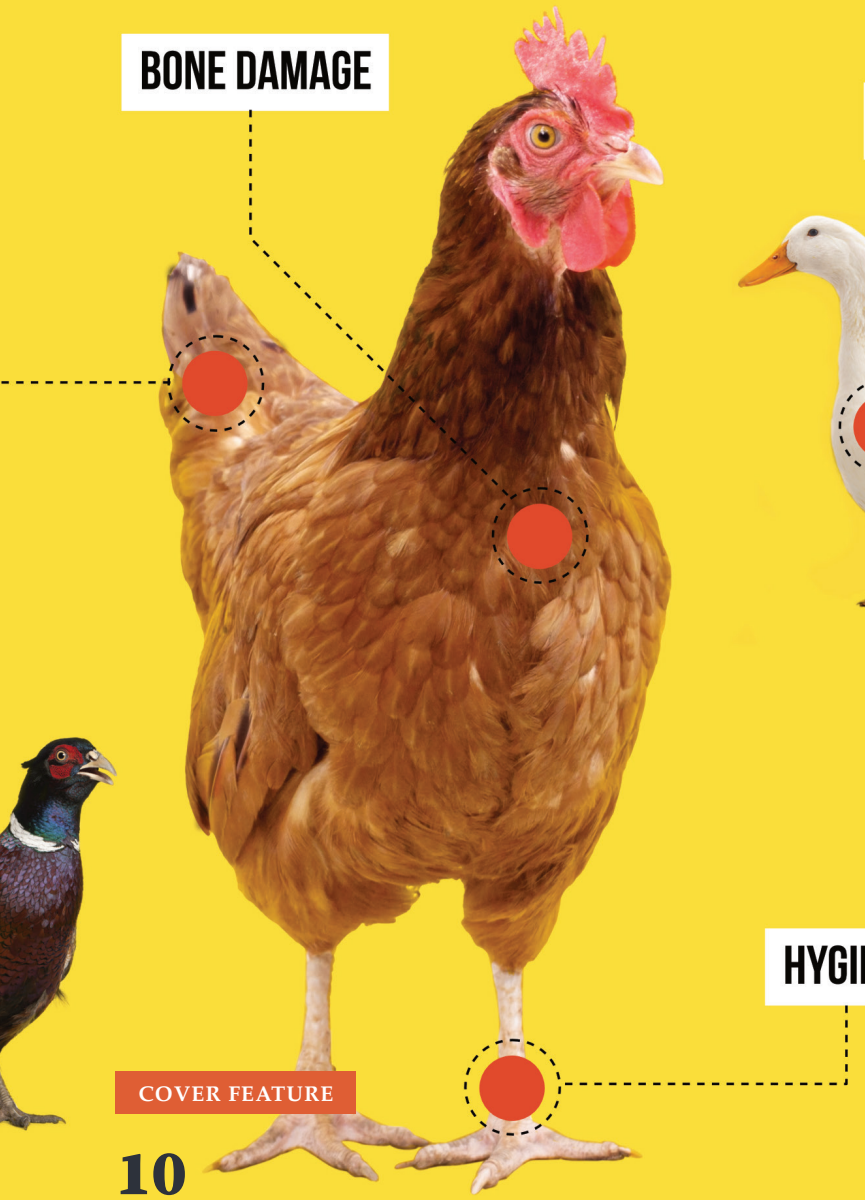

COVER FEATURE

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Keel bone damage raises welfare concerns

Melanie Epp travelled to the University of Bern to learn more about the research of Christina Rufener, Ana Rentsch and their supervisor Dr Michael Toscano who are looking into the impact keel bone damage has on behaviour, productivity and mobility.

A Bill of Rights for contract poultry farmers

USA 4 MAY 2018

Tyson Foods is launching several new initiatives aimed at enhancing communications and transparency with the thousands of independent farmers who grow the company's chickens

The company has developed a Contract Poultry Farmers' Bill of Rights, is forming an advisory council made up of poultry farmers and is investing in technology for additional communications.

"We value the farmers who raise our chickens and work hard to maintain good relationships with them, but also know we can do better," said Doug Ramsey, group president of Poultry for Tyson Foods. "That's why we're taking steps to enhance how we interact with them."

Tyson Foods has been successfully working with poultry farmers on a contractual basis since the late 1940s. The company supplies the birds, feed and technical advice, while the farmer provides the labor, housing and utilities.

The company pays more than $800 million annually to more than 3,600 independent poultry farmers who contract to raise chickens for its operations. The average farmer has been raising chickens for Tyson Foods for 15 years and some families have been raising chickens for the company for three generations.

A full copy of the Bill of Rights is available on the company's website; highlights include:

- The right to information detailing how much they are paid
- The right to discuss their contract with outside parties
- The right to a fixed length contract that can only be terminated for cause
- The right to join an association of contract poultry farmers
- The right to poultry welfare standards and training on poultry welfare standards

"The council will give growers the ability to communicate directly with top management of Tyson. They are listening and very interested in our ideas as well as issues affecting growers," said Johnny Simmons, one of the advisory council member-farmers who has grown chickens for 30 years. "The Bill of Rights that Tyson Foods has put together explains our relationship with the company and shows its commitment to our relationship. This is a working council, so we watch for results to come."

Pirbright develops a new viral vectored poultry vaccine

UK 28 JUNE 2018

Researchers at The Pirbright Institute have developed a recombinant vaccine which is effective against Marek's disease (MD) and infectious bursal disease (IBD) using a new viral vector.

Both diseases are highly infectious and associated with high mortality rates making them a constant threat to the productivity of the worldwide poultry industry for decades.

Many poultry vaccines currently use a modified herpesvirus of turkeys (HVT) to induce protection against a number of poultry diseases including MD and IBD. Although these vaccines are effective when used alone, they often fail to activate sufficient immune responses when combined with other HVT vaccines for protection against multiple diseases.

The new vaccine, developed by Pirbright's Professor Venu Nair and his team, uses the licenced MD vaccine strain called SB-1, which has a long history of working as a combined vaccine with HVT against MD. By genetically modifying the SB-1 vaccine strain, the team was able to insert protective genes from the infectious bursal disease virus and confirm the resulting virus could provide immunity against both diseases.

Click here to read the full story.

Carbon dioxide shortages in the UK: what do we know so far?

EU 28 JUNE 2018

As carbon dioxide shortages continue to affect the UK's meat industry, we've taken a look at what we know so far and how the poultry industry will respond over the coming weeks

After reports emerged from the British Meat Processors Association this month on 21 June 2018, tensions have risen as the impacts of the CO_2 shortages on the food and drink industry become more apparent.

Why has this happened?

Carbon dioxide gas is used in the production of packaging and also as a humane method of stunning at the point of slaughter. A shortage of CO_2 gas therefore affects a wide variety of foods, from cooked and fresh meat and ready meals through to pre-packaged salads.

The shortage is Europe-wide and is a result of ammonia-producing plants closing down for essential maintenance during the summer, a time when demand tends to be lower for ammonia-containing compounds, such as fertiliser. CO_2, a by-product of ammonia production, is sold on to slaughter plants and processing companies on request.

Who is affected?

Though the shortages are Europe-wide, UK companies have, so far, been hit the hardest as they are only able to purchase CO_2 from two out of the five plants that exist in the UK, while the others continue maintenance.

Beer and carbonated drinks companies, including Heineken, John Smith brands and Coca Cola, have had to cut production and sales around Europe with a number of companies halting all sales to UK pubs. Other industries, including food packaging and dry ice, are halting production and requesting buyers to cut down orders until the remaining plants come back into full CO_2 production.

However, more concerning are the animal welfare implications as some slaughter plants no longer have the capacity to correctly stun animals before slaughter, and are looking for

alternatives.

As reported by the Eastern Daily Press, the shortage of CO_2 could mean that its use is limited on the production line, meaning that shelf life could be reduced by as much as 20 percent.

Animal welfare concerns have also been raised as CO_2 shortages restrict the number of animals that can pass through for slaughter, says the British Veterinary Association. "If there are not adequate supplies of CO_2 to slaughterhouses, this could result in a backlog of animals leading to a critical animal welfare situation on farms if they cannot be processed. "In addition, the lack of CO_2 would also affect the ability of farms to carry out emergency slaughter on site," said the BVA in a news release.

What next?

"The frustration is the lack of information," said the British Meat Processors Association's chief executive Nick Allen to Eastern Daily. "We understand that several (CO_2) producers are reopening plants and restarting production, but getting information is very difficult, which makes it very

Big brands lead Nestlé push for higher chicken welfare standards in Europe

EU 29 JUNE 2018

Nestlé will help improve the welfare of millions of chickens used for food in Europe through its leading food brands 'Herta', 'Buitoni', 'Wagner' and 'Maggi'

Taking a phased approach, Nestlé will actively work with supply chain partners and stakeholders to improve living conditions for chickens, ensure the use of more humane practices and to reduce stocking density. By 2026, all Nestlé food products in Europe that use chicken as an ingredient will move to one higher standard for welfare as per the requirements set out in the European Broiler Ask (Better Chicken Commitment).

Improving animal welfare forms part of Nestlé's efforts to use traceable and responsibly sourced ingredients in its products.

Commenting on the announcement, Nestlé Zone Europe, Middle East and North Africa CEO, Marco Settembri said: "Consumers want to know where their food comes from and how it is made. As part of our commitment to source ingredients responsibly we will improve welfare standards for millions of chickens used in our food products in Europe, including our Herta, Buitoni, Wagner and Maggi ranges."

Chilled meat brand Herta will make changes in its sourcing of chicken starting 1 January 2019, as part of the longer-term transition to higher welfare standards. These products will be available under the existing Herta "Preference" mark in France.

Nestlé will engage suppliers and stakeholders to assess how chicken ingredients sourced for its Buitoni, Wagner and Maggi brands and entire food portfolio can meet higher welfare standards while maintaining consumer access to affordable, high-quality product choices.

This announcement builds on a pledge on broiler welfare made by Nestlé in the US last year and the company's decision to source cage-free eggs only on a global basis by 2025.

Click here to read the full story.

EFSA finds fipronil residues exceeding legal limits

EU 10 MAY 2018

EFSA has published its analysis of food data collected following the widespread detection of fipronil residues in eggs last summer

Member States submitted to EFSA the results of more than 5,000 samples of eggs and chicken collected between 1 September and 30 November 2017.

The samples were analysed for fipronil and other active substances specified by the European Commission. The analysis showed that 742 of the samples contained residues in quantities exceeding legal limits, almost all related to fipronil.

The majority of exceedances were found in suspect samples - those derived from products or producers where illegal use was known or assumed.

Products with exceedances of legal limits originated from eight Member States - the Netherlands, Italy, Germany, Poland, Hungary, France, Slovenia, and Greece.

The food products affected were mainly unprocessed chicken eggs and fat of laying hens. Some exceedances were reported for muscle of laying hens and egg powder.

The report has been shared with risk managers at EU and Member State level.

Background

The detection of fipronil residues in eggs by Belgian authorities in July 2017 led to millions of eggs being withdrawn from the market in the EU. The contamination was caused by illegal use of non-approved veterinary medicinal products in poultry farms.

See the scientific report here.

UK food and farming sector unites to set Brexit objectives for government

UK 29 MAY 2018

Leaders of over 100 organisations from across the nation's food supply chain have put their names to a manifesto setting out the key principles that can help ensure Brexit is a success for the supply of food in the UK.

The UK Food Supply Chain Manifesto, released 29 May 2018, has been drawn up by organisations representing farmers producing the raw ingredients and their suppliers, right through to manufacturers and retailers. It sets out the need for positive outcomes on trade, labour, regulation and domestic agricultural policy.

With little more than 10 months to go before Brexit, the manifesto emphasises the importance of ensuring our departure from the EU does not undermine the food production and supply sectors in the UK.

The manifesto has been sent to the Prime Minister by NFU President Minette Batters on behalf of the signatories, as well as other key cabinet ministers.

Minette Batters said: "Today we are presenting a united voice as a food and farming sector worth at least £112 billion to the UK economy and employing around 4 million people; a food and farming sector that meets 61 percent of the nation's food needs with high-welfare, traceable and affordable food; a food and farming sector that cares for three-quarters of the iconic countryside, that, in turn, delivers over £21 billion in tourism back to our economy.

"In the manifesto we warn, as a collective, that a Brexit that fails to champion UK food producers, and the businesses that rely on them, will be bad for the country's landscape, the economy and critically our society. Conversely, if we get this right, we can all contribute to making Brexit a success for producers, food businesses and the British public, improving productivity, creating jobs and establishing a more sustainable food supply system.

EU budget: new Single Market programme to empower and protect Europeans

EU 07 JUNE 2018

For the next long-term EU budget 2021-2027, the Commission is proposing a new, dedicated €4 billion programme to empower and protect consumers and enable Europe's many small- and medium-sized enterprises (SMEs) to take full advantage of a well-functioning Single Market

The new programme will strengthen the governance of the EU's internal market. It will support businesses' - and in particular SMEs' - competitiveness and will promote human, animal and plant health and animal welfare, as well as establish the framework for financing European statistics.

Elżbieta Bieńkowska, Commissioner for the Internal Market, Industry, Entrepreneurship and SMEs, said: "The Single Market is the beating heart of the EU. In the 25 years of its existence it has brought enormous benefits to EU citizens and businesses. For the Single Market to stay fit for purpose, we need to look after it properly. Today we are proposing a new programme to further increase the positive impact on Europeans".

Věra Jourová, Commissioner for Justice, Consumers and Gender Equality, added: "We need to ensure that consumers are able to benefit from their rights. This means providing them with practical advice on consumer issues and removing dangerous products from the market. This is what the new Single Market Programme will achieve. For the first time, we will also fund collective redress procedures, as we announced in the New Deal for Consumers."

Click here to read the full story.

Compassion's Awards celebrate continual drive for global farm animal welfare

GLOBAL 22 JUNE 2018

The winds of change continue to blow across the world's most influential food companies as more and more recognise the need to take farm animal welfare seriously

COMPASSION'S AWARDS | *The winners of the three Good Pig Awards were all UK based businesses: Co-op UK, Ella's Kitchen and Spoiltpig*

Over the last couple of years, driven by consumer demand, investor considerations and market forces, animal welfare commitments are on the rise and in the pig sector that means more, higher welfare, cage-free systems for millions of pigs across the globe.

Compassion in World Farming celebrated those companies committed to change at their annual Good Farm Animal Welfare Awards, which took place on Thursday 21 June at Les Salons Hoche, Paris, hosted by European journalist and broadcaster, Alex Taylor.

Alex said: "As a former vegetarian (now flexitarian!) - and having hosted many conferences on the subject, I'm convinced we are at a turning point in the general public's attitude towards animal welfare. I'm delighted to be hosting this year's ceremony and to have the opportunity to celebrate those companies that are doing so much, in very practical ways, to advance a cause which is, above all - simply humane. I truly believe their work is invaluable."

This year there was a total of 59 awards celebrating market-leading food businesses for their higher welfare policies and practices which are estimated to positively impact the lives of over 209 million animals each year.

Compassion's main awards (which comprise the Good Egg Awards, Good Chicken Awards, Good Dairy Awards, Good Pig Awards and Good Rabbit Awards), were accompanied this year by the prestigious Special Recognition Award and the 2018 Best Innovation Award and Best Marketing Award for the food service and manufacturing sectors.

Overall there were 14 Good Egg Awards, three Good Chicken Awards, two Good Dairy Commendations, one Good Calf Commendation, four Good Rabbit Commendations and three Good Pig Awards. Co-op UK received a Good Pig Award for its policy to only use 100 percent British outdoor-bred pigs from RSPCA Assured farms across their fresh pork, bacon, gammon, sausages and ham. This move bolsters the retailer's animal welfare credentials and means that all pigs within its producer group and wider supply chain will be born outdoors and raised in well-ventilated, spacious straw barns in line with strict RSPCA welfare standards on farms across the UK.

Click here to read the full story.

UK processors call for imported egg testing as further fipronil issues surface on the continent

UK 13 JUNE 2018

Following last year's fipronil scandal involving millions of eggs, many of which were processed, British Lion Egg Processors are disappointed that another major incident has been reported with eggs originating from the Netherlands.

With reports that a large number of eggs have again been contaminated with fipronil, British Lion Egg Processors are calling on the Food Standards Agency to launch a programme of random testing of eggs and egg products arriving in the UK.

Initial reports from The Agriculture Ministry of Lower Saxony say that a large number of eggs due to be sold in Germany have been found to be contaminated with fipronil, although the full scope and cause of the contamination remains unclear. The contaminated eggs originate from the Netherlands, the source of the original fipronil outbreak in August 2017.

Andrew Joret, Chairman, British Egg Industry Council, said: "Unfortunately, we are not surprised by these developments as we have been concerned for some time that the initial issues following the product recalls we saw last year have not been thoroughly resolved.

"With the extent of the issue unclear, we are asking the Food Standards Agency to take decisive action to protect UK food businesses, and are calling for random testing of all imported eggs and egg products. Food businesses should protect themselves by specifying British Lion eggs and egg products, which are produced to the highest standards of food safety, and reassure their customers by using the British Lion mark on pack."

The majority of eggs imported into the UK are destined for processing or the food manufacturing industry.

Managing bird welfare

Welfare is an inherent part of good management and ensuring good bird welfare will optimise the chances of maximising bird performance. A flock managed with a focus on welfare, and kept under optimal conditions, is much more likely to achieve its genetic potential. Good welfare not only includes daily management practices (such as vaccination, weighing, bird observation and record keeping) but also the house environment, nutrition, biosecurity, equipment in the house and its maintenance and the training of staff.

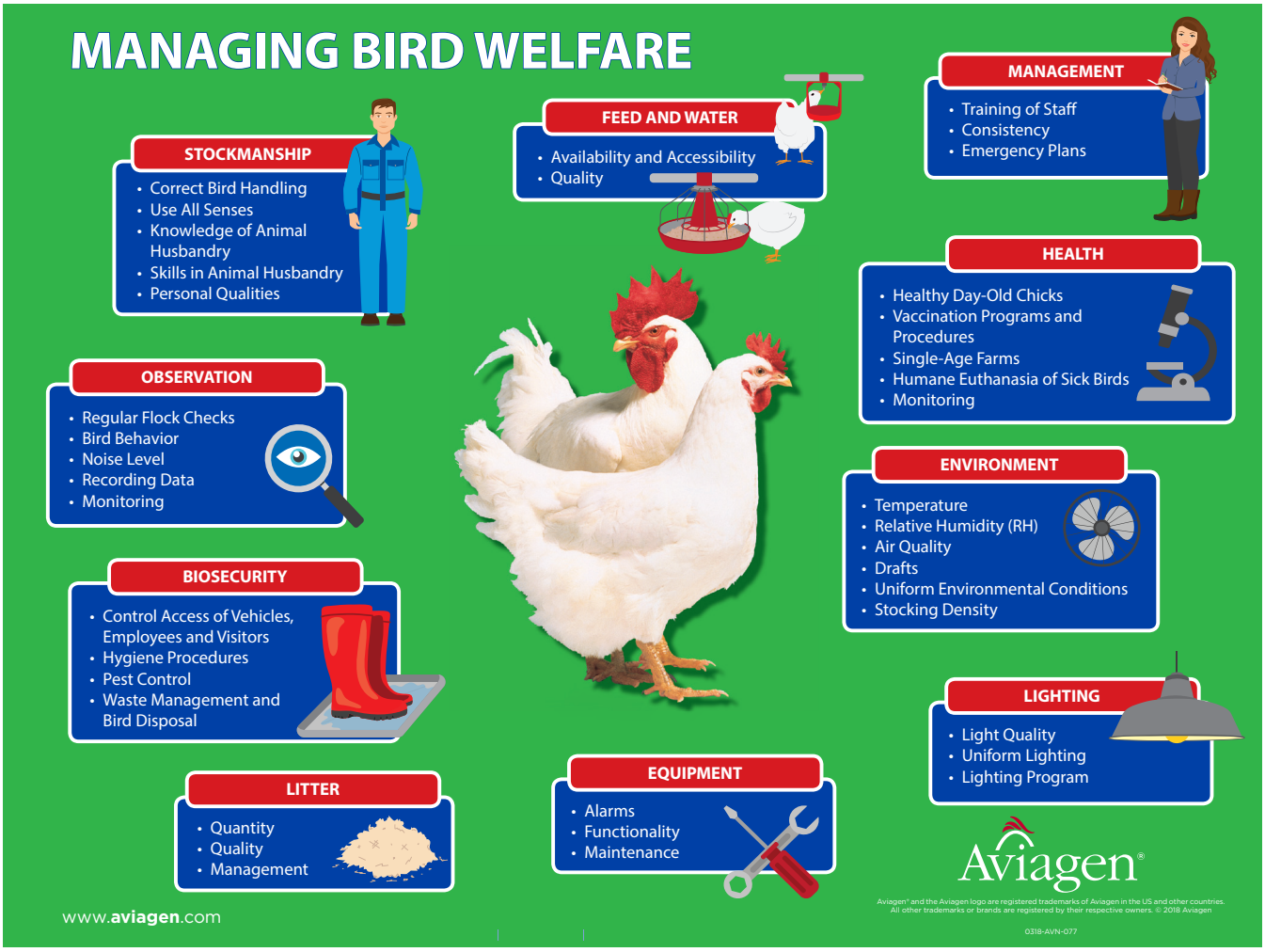
Stockmanship is a key area that directly impacts on bird welfare. The stockman must be knowledgeable in all areas of poultry husbandry and through close observation know when the flock, or perhaps more importantly, when individuals within the flock are showing signs of poor welfare. Knowing how to quickly and effectively resolve issues is vital. Bird handling must be done calmly and in the correct way for the procedure being completed, with due care and attention to bird comfort at all times. Ongoing training of staff to ensure competency and understanding is fundamental for good stockmanship and bird welfare.

At its most basic level, managing flock welfare ensures that all birds have access to good quality feed and water, and are kept in an appropriate environment suitable for their age and purpose. Appropriate vaccination programmes and continued health monitoring throughout the life of the flock must be in place. However, managing bird welfare starts even before the flock is placed. To ensure birds get off to a good start, it is essential that house has been properly cleaned and disinfected, air and floor temperatures are correct, feed and water is easily accessible and that fresh, clean litter is used. High standards of biosecurity should continue throughout the flock with clear protocols being in place to limit the risk of disease. Single age sites make cleaning and vaccination easier and more efficient with consequent benefits in bird health and welfare. It is important that the efficacy of the biosecurity procedures is reviewed regularly and updated or amended if needed.

Finally, functional and well maintained equipment within the house will promote good bird welfare and appropriate procedures must be in place in case of equipment failures. Feeding and drinking systems, ventilation systems and lighting work hand-in-hand with stockmanship, biosecurity and management practices to maintain a good poultry husbandry and welfare programme.

A good poultry welfare programme is multi-factorial, with each area playing an equal role in the success of the flock. By ensuring that the needs of the flock are met through meticulous management and attention to detail, it is possible to achieve optimum welfare, health and productivity.

For more information on key aspects of managing flock welfare refer to the Aviagen poster Managing Flock Welfare.



Keel bone damage raises welfare concerns

Two Swiss research projects evaluate how keel bone damage impacts behaviour, productivity and mobility

Words Melanie Epp

Animal welfare legislation in many European countries, including Switzerland, states that animals must be housed in a way that means normal biological behaviour is not impeded. Yet, in some cases, up to 97 percent of birds in a single housing unit will have keel bone fractures in different states of repair. Their impact on locomotion, behaviour and productivity is still unknown. To address this issue, Christina Rufener, Ana Rentsch and their supervisor, Michael Toscano, all from the Center for Proper Housing, Poultry and Rabbits (ZTHZ) in Switzerland, are conducting research on how keel bone damage impacts hen behaviour, productivity and mobility.

While we like to think that laying hens experience better quality of life in cage-free housing systems, what if all that movement leads to bone damage, which causes pain that inhibits natural behaviour? To answer this question, Ana Rentsch closely monitored 12 behaviours in 80 hens kept in eight experimental pens. Smaller spaces were chosen because of the difficulty in closely monitoring individual hens in commercial barns.

Hens wore numbered vests and cameras recorded the frequency and duration of the different behaviours at five stages of growth: three times between 26 and 30 weeks of age, and then again at the 37th and 39th week. To assess keel bone damage, hens were radiographed at the end of the 30th, 37th and 39th weeks of age.

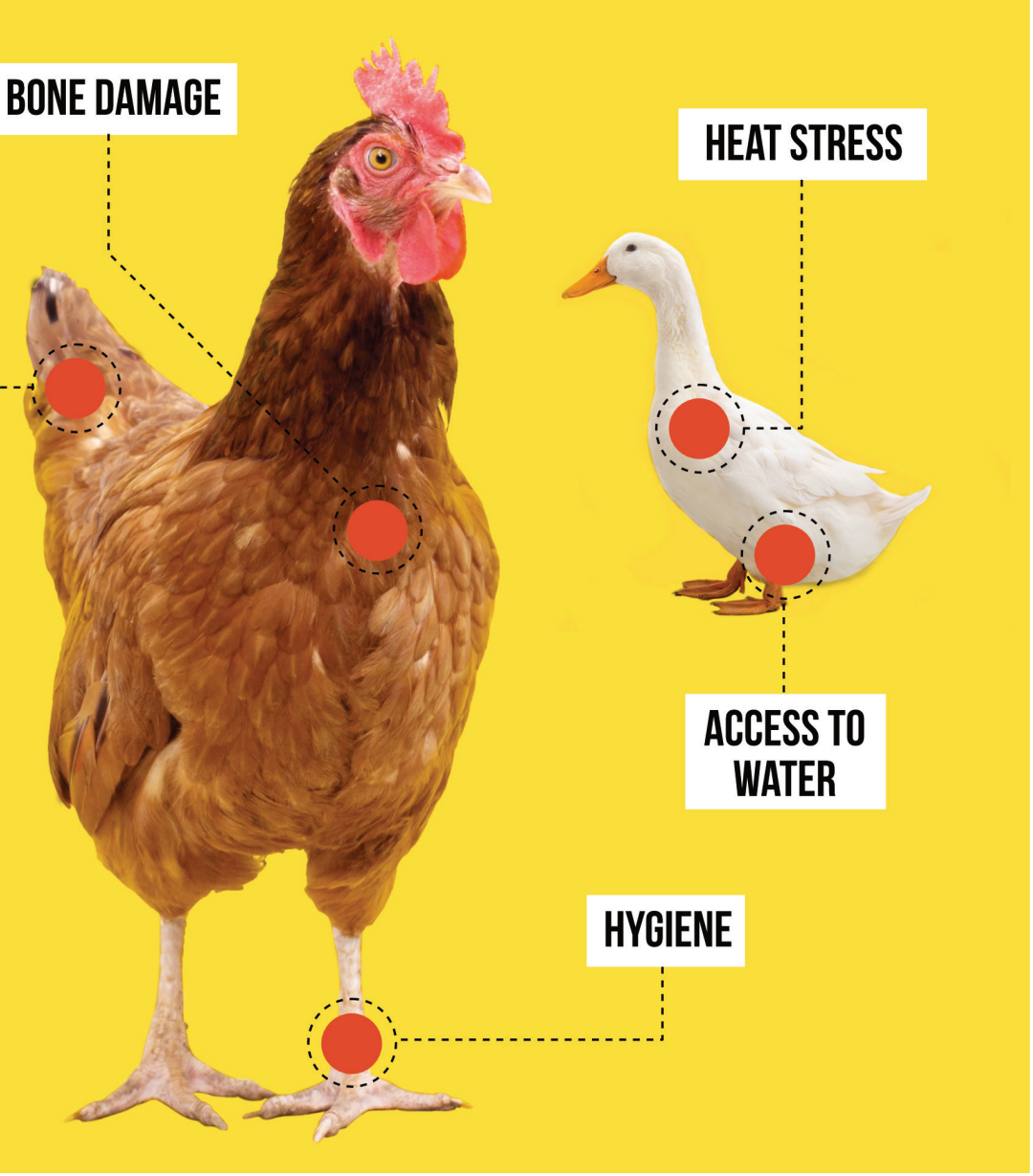
"On the X-ray images I could see whether the keel bone was broken or not and even further distinguish between fractures with open fracture gaps that are assumed to be new or unhealed fractures," said Rentsch. "Fractures without an open fracture gap are probably older and healed to some extent."

Using this data, she could then test whether hens had new fractures, healed fractures or no fractures at all, and compare it with behaviour data. To determine if the behavioural differences were truly a result of pain due to keel bone damage, Rentsch administered an analgesic during half of the observation periods and monitored the birds closely.

Preliminary results show that new keel bone fractures decrease movement between the different levels of the barn. "So we can say that keel bone fractures impact vertical locomotion while the fracture gap is still visible on X-ray images," said Rentsch. "We also saw that the walking pace on the ramp was not different for birds with fractures compared to birds without."

"Contrary to my expectations, the analgesic did not reduce the effect of the fractures on this vertical locomotion," she continued.

Furthermore, preliminary results showed that while vertical locomotion is impaired by fresh fractures, walking pace on ramps is not impacted. "This suggests that hens with keel bone



fractures can reach different levels using ramps while they would be less likely to do so otherwise," said Rentsch. "Hence, hens with keel bone fractures would benefit from ramps connecting the different levels within an aviary."

In the second study, researcher Christina Rufener examined how keel bone damage impacts the productivity and mobility of layers in aviary systems. In the first part of the study, she collected eggs from 150 focal hens approximately once a month for five days at 22 weeks of age until 61 weeks of age. By administering capsules containing dye, she was able to match the hen-specific coloured patterns in the yolk and see which hens laid which eggs. Eggs were counted and weighed, and shell strength and width were measured to calculate performance. In total, Rufener says she identified more than 7,000 eggs and analysed over 1,600 radiographs.

After egg collection, all 150 focal hens were X-rayed for fractures. On average, each hen had three fractures. Only one had no fractures at all; one had a total of 15 fractures.

"Preliminary results suggest that there was no link between keel bone fractures and egg quality, which is interesting," said Rufener. "We had hypothesised that hens would have less energy and minerals available for the egg shell because they would need it for the fracture."

Preliminary results also showed that with increasing age, hens with extremely severe keel bone fractures laid fewer eggs the more severe their fractures were. "Hens with extremely severe keel bone fractures laid approximately 16 percent fewer eggs than hens with no fractures at the age of 61 weeks," said Rufener. "This suggested that hens could maintain their high productivity until shortly after peak of lay – so 37 weeks – but repartitioned their resources from reproduction towards the fractures later."

In the second study, Rufener used an infrared tracking system to track hen mobility to see whether or not it was impacted by keel bone damage. The tracking system recorded hen movement through five zones: the winter garden, litter, lower tier, nest box tier and upper tier.

"We collected data approximately once a week for six days per time point and X-rayed hens afterwards," Rufener explained. "We could then relate keel bone fracture severity with the total number of transitions between zones and the duration of stay in each zone."

The infrared tracking system did not record the movement within locations – it recorded location only and thus when hens moved between locations. For this reason, conclusions could not be drawn as to an individual hen's actual behaviour in a location.

Preliminary results show that there is no link between fractures and the total number of zones a hen crossed per day. "This is not what we expected," said Rufener. "We predicted that hens with fractures would be in pain and therefore move less."

"However, there seems to be a shift in location," she continued. "With increasing fracture severity, hens spend more time on the top tier and less time in the litter and lower tier."

It should be noted that food and water were available on the top tier, and the nesting box was only one tier away. As a result, it may be that hens spend time in the top tier to avoid movement or because they feel safer there.

Both Rentsch and Rufener's studies make the case for the use of ramps in cage-free, tiered aviary systems. Connecting the different tiers should facilitate movement between tiers and reduce the keel bone damage that results from falls and collisions. PD

ZTHZ is a collaborative research centre between the University of Bern and the Federal Food Safety and Veterinary Office of Switzerland. The keel bone damage projects were funded by grants from the Swiss Federal Food Safety and Veterinary office.

A fairer prospect for waterfowl

A progress report on three top issues

Words Treena Hein

Ducks and geese are raised for meat and egg production in many countries, and the most significant current welfare issues include the plucking of feathers from live birds, force-feeding practices related to foie gras production and a lack of full-body access to water for the expression of normal behaviours such as swimming.

Sophie Elwes, senior scientific officer at the RSPCA in the UK, notes that it's difficult to say which is of the greatest concern, both in Europe and globally. "The two aspects are the severity of the suffering, from forced feeding to behaviour frustration, from the very cruel down to poor welfare," she notes. "And then you have the scale of the suffering. There are not many countries that have foie gras production, and live plucking happens in Hungary and Poland and China, but full-body access to water I would say is not something that is provided except on small free-range operations. Consumers aren't generally aware that ducks raised for slaughter don't have access to water for swimming.

> "The science is very clear that ducks and geese, being waterfowl, require access to an open water source"

Dr Sara Shields, behaviour and welfare specialist for farm animals at Humane Society International notes that while there has been progress addressing the live plucking and force-feeding issues, the problem of access to water has received less attention. "The science is very clear that ducks and geese, being waterfowl, require access to an open water source," she notes, "to meet their behavioural needs."

In 2008, the RSPCA commissioned University of Cambridge scientists to examine what facility design best enables ducks to carry out normal water-related behaviours. Updated RSPCA welfare standards were published in 2015, but Elwes says these have not been adopted. She notes that one company now owns all major duck production in the UK, and Elwes says there is no indication that this company is going to make changes.

"The DAS rules state that water systems should be designed to allow water to cover the head and be taken up by the bill so that the duck can shake water over the body without difficulty"

For its part, the British Poultry Council (BPC) states on its website that "producers are encouraged to seek designs of water facilities that fulfil the water-related preening behaviours of ducks. It is this latter requirement that has brought the RSPCA into conflict with the BPC over the Duck Assurance Scheme (DAS, a voluntary scheme launched by the BPC in 2010, which will be handled by assurance body Red Tractor on 1 July https://assurance.redtractor.org.uk). The DAS rules state that water systems should be designed to allow water to cover the head and be taken up by the bill so that the duck can shake water over the body without difficulty. Where drinking water is provided by nipple drinkers, the DAS requires that additional bathing water must be provided [through the use of] troughs, wide-channel type bell drinkers, baths or showers."

BPC public affairs manager Shraddha Kaul states that over 90 percent of the UK duck producers are members of DAS but does not confirm that they are carrying out DAS standards. "The provision of water for bathing is meeting the needs of the birds as well as protecting their well-being," states Kaul, adding that, "The BPC established the DAS in the absence of any UK or EU legislation. We've done the research into provision of water, stocking densities and welfare outcomes." Elwes notes that it wouldn't cost much to have troughs, wide-channel bell drinkers, baths or showers added to duck barns, but it would reduce stocking density a little.

Foie gras

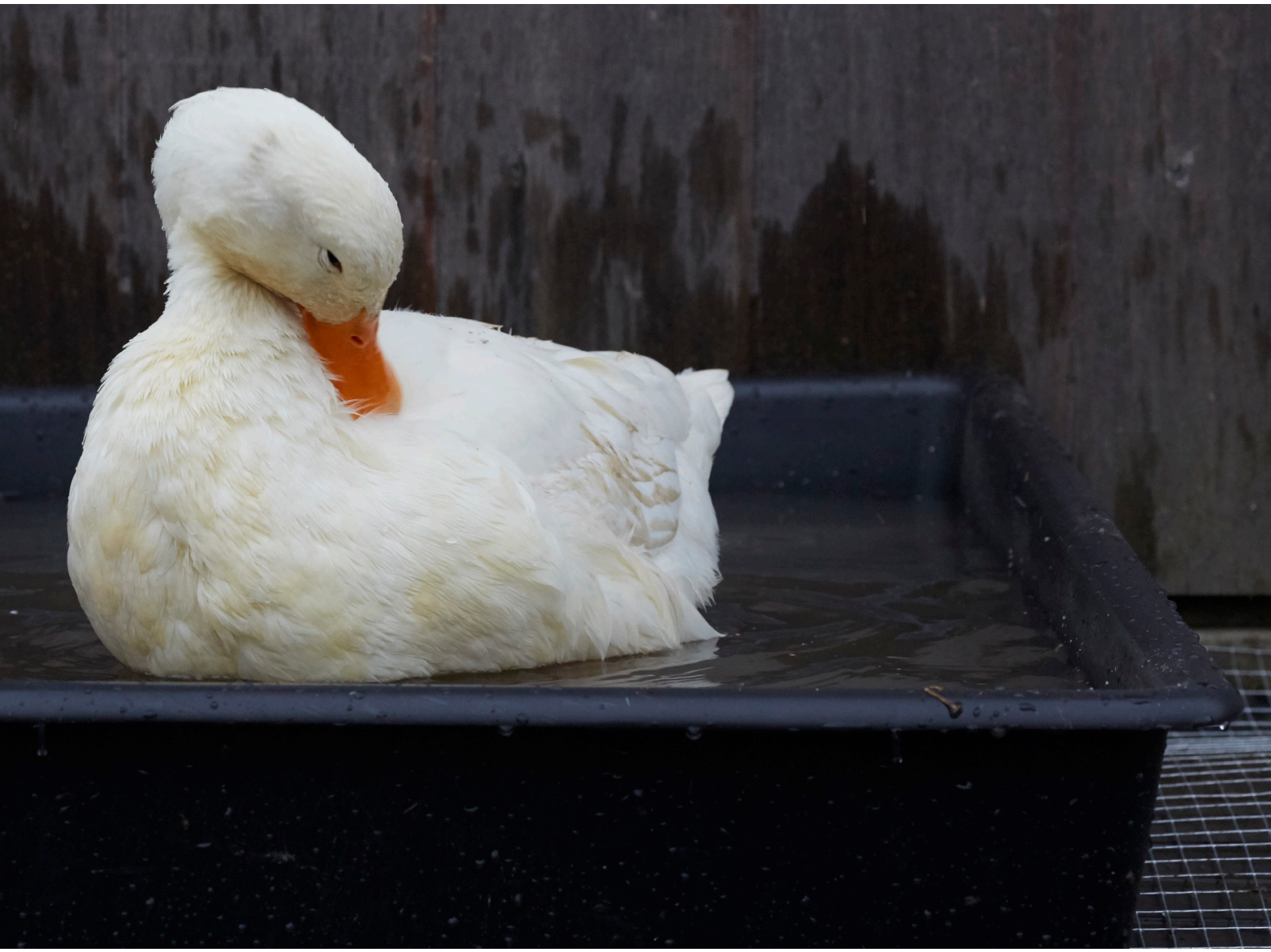
The liver pâté known as foie gras is made through the practice of gavage, where ducks and geese of about 12 weeks old are held and repeatedly force-fed twice a day for about two weeks through a pipe to enlarge their livers. There are reports that each bird is kept in a small cage during this period, with its head held permanently in an opening to make gavage easy and quick. Welfare concerns obviously relate to confinement, possible damage to birds' throats and liver failure.

Import of foie gras is banned in India, Australia and Argentina, and production is banned in the Czech Republic, Denmark, Finland, Italy, Germany, Luxembourg, Norway, Poland, Turkey, the UK, most of Austria and, in North America, in California (where the ban was unsuccessfully

appealed last year). In 2012, some European MPs urged an EU-wide ban on production and sale, but no major push has happened since. With an estimated 35,000 people involved in the industry in France and recognition of foie gras in French law as an important part of the country's gastronomic heritage, it seems unlikely France would ever agree to a ban.

Live feather plucking

Live plucking of down is conducted either so downy feathers can regrow or so that these feathers are removed before they might be damaged or dirtied through the slaughtering process. Most of the world's down is sourced from Eastern Europe and China. Shields reports that major outdoor clothing brands including Patagonia and The North Face have enacted welfare policies "that require no live plucking or force-feeding in their supply chains" and that "many of the brands that have good animal welfare policies for down sourcing use the international Responsible Down Standard". PJ Smith, senior fashion policy manager at the Humane Society of the United States (HSUS) adds that down-free alternatives are beginning



“The HSUS’s duck report states that the catching, crating and transportation of ducks for slaughter “may inflict physical injury and heat and cold stress, as well as cause fear”

to “take off now that companies like Patagonia and VF Corp are promoting them as lighter with more insulation. As goes Patagonia, so goes the industry, eventually.”

Transport, slaughter and growth rate

The HSUS’s duck report states that the catching, crating and transportation of ducks for slaughter “may inflict physical injury and heat and cold stress, as well as cause fear,” and “that the slaughter process itself, from dumping and shackling to stunning and throat slitting, is traumatic”. Shields adds that US federal humane slaughter legislation excludes poultry, “so there is no legal protection for these animals at slaughter”.

As of May 2018 closed-circuit cameras are required in every slaughterhouse in the UK, which Elwes sees as a positive step achieved after many years of campaigning that will, she hopes, make sure proper practices are employed.

Shields notes that another duck-welfare issue is growth rate, since rapid weight gain can leave the ducks “prone to lameness and leg disorders. This may leave birds in chronic pain.”

In terms of the future in the UK, Elwes says there may be an opportunity with the UK leaving the EU to get higher species-specific welfare standards put in place. She notes that the current government farm subsidies are based on how much land is farmed and that in the future the UK government may be open to tying the subsidies to higher welfare standards. PD

Farming in focus

Meet the people driving change in their industry

Words Ryan Johnson

Lisa Henning Beohm
Henning Companies

The International Egg Commission Business Conference was held in London this year, and we attended to find out what the humble egg has been up to around the world. We were struck by one story about welfare that took a different angle and focused on an incident of human trafficking. During times of increasing transparency and consumer demand for high welfare food, the social side of sustainability often gets missed in discussions of animal and environmental protection.

Lisa Henning Beohm in business development for the agricultural division of her family's construction business, Henning Companies. She is the fourth generation to take up leadership in this company, which is a general contractor with a specialisation in building layer houses, hatcheries and feed mills for the US and international egg industries. Her family likewise partners in several egg farm partnerships in Iowa and Ohio which range in both size and scope from 1.17 to 16 million hens with a collective total of over 35 million hens.

Could you share the human welfare incident your company was faced with?

As I was not present for the events, my information is limited, which I must make clear from the start. What I'm sharing is the recounting of what I, as a family member and partner in Versova, have learned of what occurred.

In December 2014, our farm in Ohio was served with a subpoena for records of employees residing at a trailer park. Although this was the first our team had heard of any issue, they were quick to respond. Later the same day, federal law enforcement officials from the FBI came to the farm's offices looking for a specific individual. That employee, they determined, was not a farm employee, and the assumption was made that if this person was present on the farm, he was likely a contract flock services worker. Our team swiftly took the FBI contacts to the location where our labour supplier had employees working.

While at the farm, law enforcement identified two other contract employees believed to be victims of human trafficking. With the farm's assistance, the three individuals were safely escorted without incident from the farm by FBI officials that day. This was a situation the management team took very seriously, and an internal investigation began. It was subsequently determined that our third-party contractor had misled us and clearly violated many terms of our contract, including the employment of unauthorised workers and compliance with national, state and local immigration laws.

What did your company do to confront this incident?

It was clear our farm had to terminate this contractor. However, you can't just eliminate a flock services crew overnight without compromising hen care. But over the following weeks, we transitioned their services to internal crews and terminated their contract.

We now know that those indicted pled guilty in mid-2015 to the labour trafficking charges against them. Their crimes included hiring underage workers, falsely representing themselves to federal agencies, making promises of education that were not true, keeping them in substandard housing, and the list goes on.

While our farm was clearly misled time and again by this contractor, it was our obligation to take steps to prevent this from happening again. There is no question that for those of us who work in agriculture – and especially in egg production – there are many lessons to be learned from what we experienced.

What were the ultimate outcomes?

First, a number of measures were put in place, including the elimination of most contract labour on our farms. And since this situation occurred, we have expanded independent and regular auditing of our employment records, have updated our hiring and training protocols, and are requiring all contractors to sign in with proper identification at a central location.

We also looked for ways to learn more; we researched and found a partner who knew more about this than we ever could – the team at Polaris Project, based in Washington, DC. Polaris was different from some of the human trafficking activist groups – they understood business, they worked with many of our customers already, and they were positioned to give us extensive support, without judging us for what had happened. They had done some work in other areas of agriculture, and also had vast experience in other industries with high exposure to human traffickers.

Working with Polaris and their partner, Verite, we had them conduct audits at the farm to assure we had the proper labour protocols in place. We gave them broad access to our farms, our leadership and our records. It is important to understand that this is not a certification program – this is an education program – so their work was to shore up our internal processes, address any gaps, and provide recommendations of additional measures we should implement. I am proud to say we have done so.

We have provided human trafficking training, with the assistance of the Polaris team, to both senior staff and supervisors. We have an ongoing internal employee communications campaign that includes posters, continuing education and an anonymous hotline that rings right to Polaris, if anyone wants to report suspected trafficking. To date, no complaints have been received.

To your knowledge, how much of an issue is social sustainability/ human welfare in the egg and poultry meat sectors?

The US Attorney working on prosecuting the contractor said it best, "This case is a stark reminder that human trafficking hides in plain sight all around us. It underscores the need for all of us to be vigilant where we live and work. When something seems suspicious, we need to report it, not ignore it."

We now know first-hand just how good traffickers are at hiding their crimes and have also learned that there are operations and services related to egg production that provide points of entry for human traffickers. Due to the serious labour shortages much of the agriculture sector is experiencing, and reliance on immigrant labour to fill those gaps – this becomes an area of risk and can be a point of entry for human trafficking.

"We now know first-hand just how good traffickers are at hiding their crimes and have also learned that there are operations and services related to egg production that provide points of entry for human traffickers"

What can producers do to ensure they are ensuring human welfare in their operations?

Our egg farm partnership has shared this story with media, with the US egg industry and with customers. And I shared it at the IEC London business conference for the same reason. The more we can educate those of us who work in egg production about what happened on our farm, the less likely the situation is to be repeated.

United Egg Producers invited Polaris to speak at last year's annual meeting to spread awareness about human trafficking and help egg producers better identify areas of risk and signs to look for. This presentation was made available to all members of UEP to use for their farm/company's employee education. I suggest producers work with a reputable company, like Polaris, to help educate management, employees/staff, ensure proper audits and protocols are in place, ongoing internal employee communications, as well as access to an anonymous hotline.

Increasingly, society wants to know more about where their food comes from. They want to know that if we're using animals in agriculture that they're being cared for humanely and that we care about the environment; they demand to know companies are doing more than just maximising their profits. This level of transparency and focus on social sustainability is not going to disappear.

As IEC Chairman Tim Lambert said, "companies have a responsibility within society to not only do the right thing for the right reasons but still be profitable. To be proactive about these things and understand where society is going will help us to lead with a vision of continuous improvement and elevate our industry." PD

Ms Beohm is involved with multiple organisations, including as a board member of the Ohio Poultry Foundation, Government Relations Committee of United Egg Producers, Iowa Poultry Association's Structure Committee for Emerging Leaders Program, Iowa Egg Council Public Relations & Key Influencers Committee, and as a second-year participant of the International Egg Commission's Young Egg Leader programme

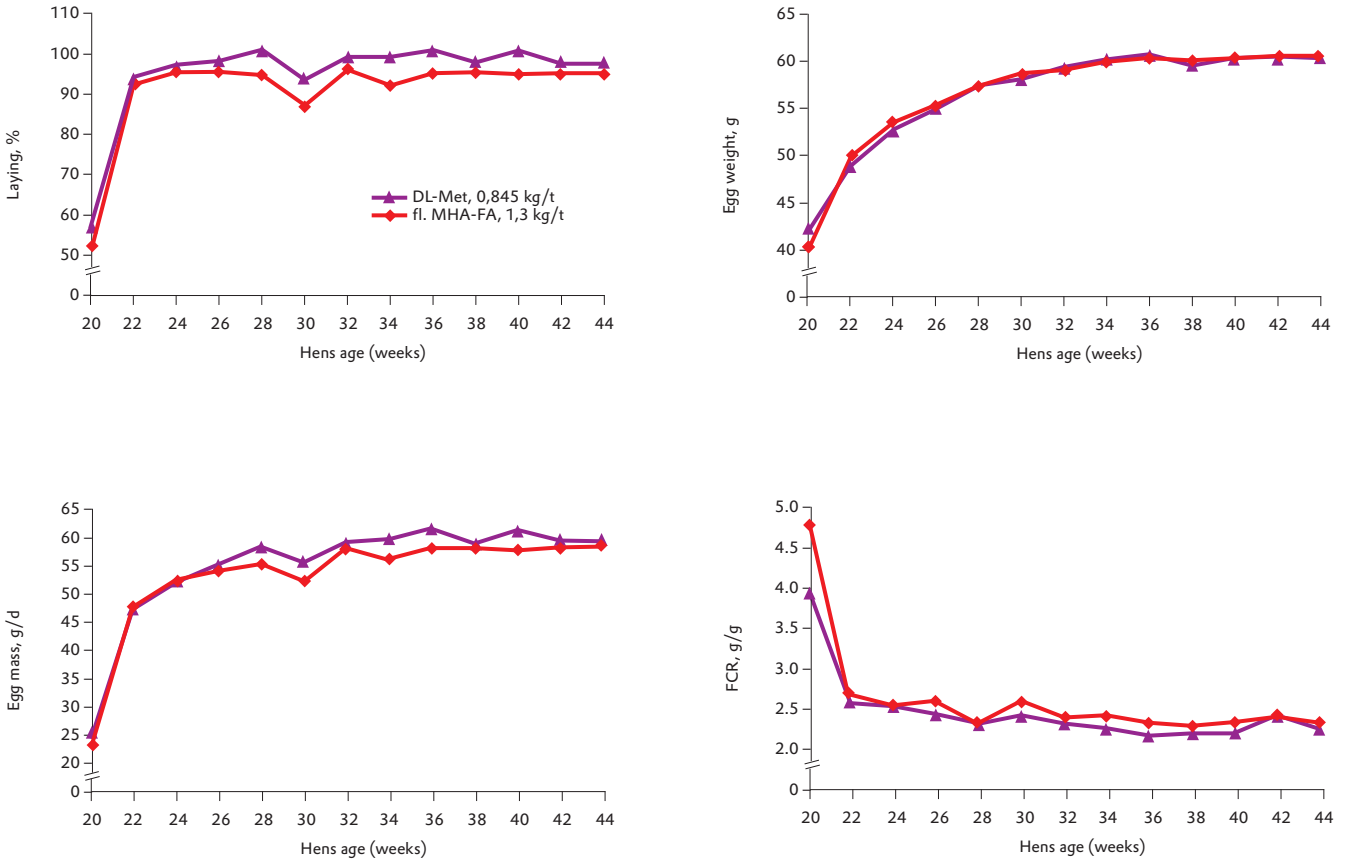
DL-methionine can replace methionine-hydroxy anlalog products in a ratio of 65:100 in laying hen feed.

Carlos de la Cruz and Andreas Lemme

Three recent feeding studies confirm that supplying laying hens with adequate dosages of a methionine is necessary to optimize performance, but moreover, products of the methionine-hydroxy analog (liquid MHA-FA; MHA-Ca) are interchangeable with DL-methionine at a ratio of 100:65, without having any negative effect on egg production performance. Assessment of the relative bioavailability of MHA products should be reflected both in the respective dosages and in the purchase price of the products, in order to optimize feed costs.

For many years a discussion on chemical and biological characteristics of DL-methionine (DL-Met) and the hydroxy analogue products of DL-methionine (liquid methionine-hydroxy analog, MHA-FA; methionine-hydroxy analog calcium salt, MHA-Ca) has continued in the feed industry, including bio-efficacies of the compounds in different productive animal species. Therefore a number of studies have been carried out to demonstrate that MHA products in feed can be replaced through DL-Met at an exchange rate of 65 % compared to the MHA dose without any negative effect on performance.

FIGURE 1



Laying performance (upper left), mean egg weight (upper right), daily egg mass (lower left), and feed conversion of laying hens that received feed over a period of 180 days that contained liquid MHA-FA(red) and DL-methionine at a replacement ratio of 100:65 (Univ. Appl. Sci. Osnabrück, 2017).

In this context, a Bachelor thesis was written at the University of Applied Science in Osnabrück, Germany. Furthermore, a feed test was conducted at the International Poultry Testing Station in Ustrasice in the Czech Republic and finally a trial was carried out by the Veterinary Faculty of the National Autonomous University of Mexico in Mexico City. These 3 recent works examined the recommended interchangeability of the methionine sources at a 100:65 ratio in laying hen feed under different production conditions.

126,000 WHITE LAYING HENS OF A COMMERCIAL OPERATION WERE AVAILABLE FOR A LARGE SCALE TRIAL IN GERMANY.

In the area around Osnabrück in Germany, a 180 days (two feeding phases) commercial test was carried out using a total of 126,000 ISA-Dekalb White hens 20 weeks of age. Layers were held in 2 houses with 2 floors and 6 aviaries per floor. Various performance parameters including feed intake, laying percentage and egg weights as well as body weight and plumage quality were recorded. Feeds tested differed only in the methionine source used. Whereas liquid MHA-FA was used in standard feed (1.30 kg/mt), experimental feeds contained 0.845 kg/mt DL-Met which is equivalent to a ratio of 100:65. Phase 1 and phase 2 feeds contained 17% and 16% of crude protein, respectively.

The cumulative results (Figure 1, Table 1) draws the conclusion that using DL-Met at a quantitative ratio of 65% has no disadvantageous effects compared to the use of liquid MHA-FA, as reflected particularly in laying performance, egg mass, and feed conversion. Furthermore, it can be seen that the curves for laying performance, daily egg mass, and feed conversion ratio actually show slight improvements starting at the 23rd week.

LONG-TERM STUDY IN CZECH REPUBLIC USING BROWN HENS IN ENRICHED CAGES.

A second study also explored the interchangeability of methionine products in 18 weeks old Isa-Brown layers. During trial duration of 32 weeks 1440 hens were tested in enriched cages in groups of 30 at the International Poultry Testing Station Ustrasice, in Czech Republic. A typical European diet based on wheat, maize, soybean meal and wheat bran was the basis for the 5 treatments and represented the control group (n=12) that contained no methionine supplement and had a methionine + cysteine content of 0.53%. Two additional groups (n=9 each) with 1.2 or 2.4 kg/mt MHA-Ca and two further treatments (n=9 each) in which DL-Met was added to the feed at amounts of 0.78 and 1.56 kg/mt corresponding to a replacement ratio of 100:65 for the two inclusion levels completed the trial design. The lower dosage was included to make the test more sensitive.

As expected, negative control group performed worse than the other treatments. Supplemented MHA-Ca and DL-Met in general improved performance, therefore it can be concluded that supplemented methionine was essentially required for

TABLE 1 Mean performance during a period of 180 days (week 20 to 44, week) Dekalb White layers, fed with supplemented with liquid MHA-FA or with 65% of the dose using DL-methionine (Univ. Appl. Sci. Osnabrück, 2017).

	Liquid MHA-FA	DL-methionine
Live weight (kg)	1.642	1.636
Plumage quality*	1.80	1.84
Laying performance (%)	91.7	95.1
Egg weight (g/egg)	56.9	56.8
Egg mass (kg/kg)	52.2	54.1
Feed consumption (g/day)	117.9	116.3
Feed conversion (kg/kg egg mass)	2.42	2.27

Due to the test setup with a low number of repetitions (n=2) per feed variant, the statistical analysis did not show any differences between the variants.
* A 4-level quality classification with used, where Level 0: No flaws, Level 1: Up to 1 cm^2 flaw, Level 2: > 1 cm^2 , <25 cm^2 flaws, Level 3: > 25 cm^2 flaws

TABLE 2 Performance evaluation with two supplement levels (suboptimal; requirements based) of MHA-Ca or DL-methionine at a quantitative ratio of 100:65 of brown laying hens (Poultry Testing Station Ustrasice, 2017).

Met+Cys supplement	Control	Suboptimal		Requirements-based	
Methionine source	–	MHA-Ca	DL-methionine	MHA-Ca	DL-methionine
Laying performance (%)	80.8	85.2	85.3	85.5	86.0
Egg weight (g/egg)	59.7	61.9	62.0	62.2	62.2
Egg mass (g/d)	48.2	52.7	52.9	53.2	53.4
Feed intake (g/day)	140.5	131.4	133.1	133.0	132.6
Feed conversion (kg/kg)	2.87	2.48	2.49	2.47	2.47

(P<0.05)

TABLE 3 Performance data from a feed test with Bovans layers using 2 supplement levels (suboptimal; requirements-based) of either MHA-FA or DL-methionine at a quantitative ratio of 100:65 (Veterinary Faculty of the National Autonomous University of Mexico, 2017)

Met+Cys supplement	Control	Suboptimal		Requirements-based	
Methionine sources	–	Liquid MHA-FA	DL-Methionine	Liquid MHA-FA	DL-Methionine
Laying performance (%)	80.44^{c}	86.38^{b}	86.86^{b}	89.90^{a}	89.95^{a}
Egg weight (g/egg)	55.9^{b}	58.6^{a}	58.9^{a}	59.2^{a}	59.5^{a}
Egg mass (g/d)	45.0^{c}	50.7^{b}	51.2^{b}	53.5^{a}	53.5^{a}
Feed intake (g/day)	104.5	104.7	104.5	104.5	104.7
Feed conversion (kg/kg)	2.34^{a}	2.07^{b}	2.04^{bc}	1.96^{cd}	1.96^{d}

Means within rows with common superscript differ significantly (P<0.05), Tukey Test

optimized performance. However, the differences between the two supplement levels were small and can be seen in numerical differences in daily egg mass (0.5 g/d) and feed conversion (1 – 2 points).

LAYERS ALLOCATED IN CONVENTIONAL CAGES UNDER MEXICAN PRODUCTION AND FEEDING CONDITIONS

A third experiment with similar setup as the previous trial was ran in Mexico. The trial used 420 Bovans layers of 37 weeks of age, held in conventional cages fed with a sorghum and soybean meal based diet. Five treatments with 7 replicates of 12 birds/replicate included a control group with no methionine inclusion, 2 treatments with suboptimal (50 %) level of 1.27 kg/mt liquid MHA-FA and 0.83 kg/mt of DL-Met and 2 additional treatments with an inclusion of 2.25 kg/mt liquid MHA-FA and 1.66 kg/mt of DL-Met. Dosages of methionine sources at both dosages equaled a ratio of 100:65.

Production parameters after 12 weeks displayed in Table 3 showed a significantly lower performance of the control group, as expected. Whereas increasing dosage of methionine sources gradually and significantly increased performance, there were no differences between methionine sources in corresponding treatments. Similarly as observed in Czech Republic, it can be concluded that supplemented methionine was essentially required for optimized performance. Also, this trial confirms the interchangeability of the methionine sources at a quantitative ratio of 100:65.

THERE REMAINS NO DOUBT ABOUT THE INTERCHANGEABILITY OF THE METHIONINE SOURCES AT A RATIO OF 100:65 AND - MOST IMPORTANT – THIS HAS SIGNIFICANT ECONOMIC ADVANTAGES.

Comparing the corresponding groups treated with MHA products and DL-Met, it can be confirmed that the quantitative replacement ratio of 100:65 (MHA products: DL-Met) had no negative effects on laying hen performance. Therefore, at a DL-Met price of 2.50 €/kg, respective MHA product price should be 1.62 €/kg, corresponding to 65 % ratio. In other words, MHA products would not be competitive with prices higher than 1.62 €/kg compared to DL-Met at 2.50 €/kg. So, purchasing MHA products at a price higher than 65 % of the price of DL-Met will reduce profitability.

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Getting to the bottom of the pile: solving the mystery of piling behavior

With no obvious cause, piling raises welfare concerns for poultry producers

Words Melanie Epp

Globally, many egg producers are making the switch from conventional cages to non-cage aviary systems for laying hens. The benefit of these open systems is that they allow the hens to move freely from feeders to perches and floors to nest boxes. For birds, this freedom means that they can perform natural behaviours, like ground pecking, scratching and dust bathing. There are downsides to these more open systems though. One of those downsides is piling, which leads to smothering where hens suffocate as a result.

It's a behaviour that poultry welfare researchers from the Center for Proper Housing, Poultry and Rabbits (ZTHZ) in Switzerland – a collaboration between the University of Bern and Switzerland's Federal Food Safety and Veterinary Office – are trying to better understand.

Led by PhD student Jakob Winter, the project has both explorative and experimental components. The explorative study looks at the underlying mechanisms and associated factors that lead to piling behaviour on Swiss layer farms. The experimental study will try to validate the factors the researchers believe cause piling behaviour. From there, they hope to develop preventative measures to curb the behaviour. Supervised by Ariane Stratmann and Michael Toscano, the project was funded by a grant from the Swiss Federal Food Safety and Veterinary Office.

During the explorative part of the project, Winter and his team visited 13 Swiss farms with flock sizes that ranged between 1,000 and 8,500 birds. The farms

> **"The experimental study will try to validate the factors the researchers believe cause piling behaviour. From there, they hope to develop preventative measures to curb the behaviour"**

were selected based on survey results. The researchers installed cameras and environmental data loggers to monitor temperature fluctuations and gas concentrations. They even made audio recordings to find out whether piling incidents might be triggered by sudden noises that caused the birds to run in alarm.

In open aviary systems, smothering that results from piling is more common than one might think. In the explorative study, for example, smothering incidents occurred in eight of the 13 flocks. Seven of those experienced regular losses of two to five birds per week. One farm lost 60 hens in one single smothering event, a loss that cost him approximately CHF 3,000.

From barn to barn, the duration of piling events differed greatly. Some events lasted just 30 to 90 seconds. Others lasted as long as two hours and 40 minutes. There is increased risk in the longer-lasting piles, said Winter.

“From barn to barn, the duration of piling events differed greatly. Some events lasted just 30 to 90 seconds. Others lasted as long as two hours and 40 minutes”

The number of events per farm also varied. Whereas one farm experienced just one piling event per day on average, another one had 100 in one day.

“What I think is interesting as well is the location of the piling events because it’s always the same location in the barn where piling is occurring,” said Winters. “If you look at the videos, you can actually predict where the next piling event will occur.”

Winter’s supervisor, Toscano, is also interested in finding out why the birds don’t disperse. “The birds flock when there’s something interesting,” he said. “But, at some point, they should no longer be interested and leave, but they don’t.”

Factors that might contribute to piling include unevenly distributed barn light, temperature differences, sudden mass movement and attraction – as in, one hen pecks at something and raises the curiosity of the others.

To test the potential cause, the researchers chose three factors – light, temperature and a novel object – that might trigger piling, set them up in a test facility

"For the purpose of this experiment, on-site technician Markus Schwab assisted in the task of developing a welfare-friendly detection and dispersal system"

and assessed the birds' responses. All factors could be controlled and switched on and off at will.

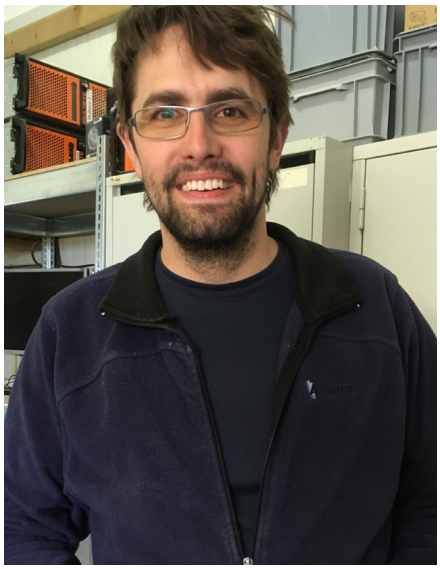
Currently, farmers struggle to disperse birds when they begin to pile, as they don't have a humane dispersal method at their disposal – electric fences are not allowed in Switzerland. The researchers would like to consider different dispersal methods in a future project.

"The federal government wants to develop solutions," said Toscano. "They want to be able to tell farmers what they can do, and right now they don't really have any options."

For the purpose of this experiment, on-site technician Markus Schwab assisted in the task of developing a welfare-friendly detection and dispersal system. When the infrared detection system he designed picks up on a piling incident, hens are dispersed using feed. This is what has kept them from smothering during the experimental phase.

Until dispersal methods are developed, farmers will have to look closely at the layout of their barn to try to determine which factors are contributing to the piling event.

"Interestingly, it's always the same corner," concluded Winter. "That makes me certain that there is something that they can do, that there is something that attracts hens, and that piling is actually the cause of smothering."



WELFARE FOCUS | *Markus Schwab developed a welfare-friendly detection and dispersal system*

Final results from Winter's research will be available in the near future. If you would like to find out more, contact Michael Toscano at the Center for Proper Housing, Poultry and Rabbits (ZTHZ) at the University of Bern. PD

Why water access is the secret to duck health

Words Dr Lauren Edwards

Pekin ducks are the most commonly farmed breed of meat duck, and are derived from the wild mallard. With migratory waterfowl as its ancestor, it's not surprising that water is still a very important resource for farmed ducks. Research has shown that ducks prefer to drink from an open water source, such as a trough or cup drinker, rather than a nipple drinker, and will work hard to gain access to open water.

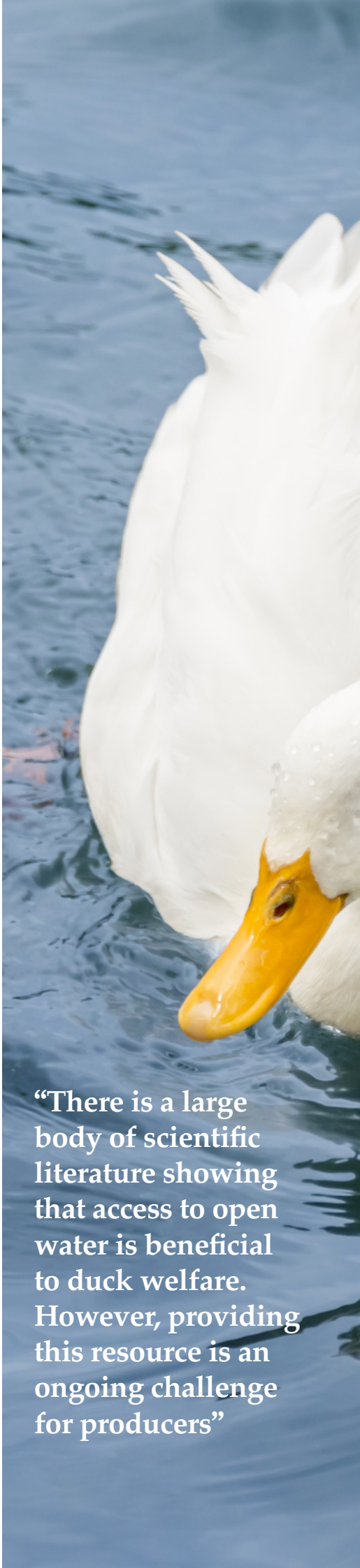
They rely on water for maintaining their plumage in good condition and keeping their eyes and nostrils clean. They do this by submerging their heads under water, and thus need an open water source for optimal preening conditions. Ducks also use water to regulate their body temperature during periods of heat stress, and access to open water is especially important for ducks farmed in tropical conditions.

There is a large body of scientific literature showing that access to open water is beneficial to duck welfare. However, providing this resource is an ongoing challenge for producers. In comparison to other poultry, ducks consume a lot of water and excrete a lot of water. In fact, their faeces can consist of up to 90 percent water, which poses obvious difficulties in terms of keeping their litter dry.

Compounding this issue is the additional water which is splashed onto the floor during preening bouts, and open water sources can quickly result in a messy house with wet litter if not managed correctly. Wet litter causes poor foot health, and is associated with **hyperkeratosis** and necrosis of the footpads. In addition, the tendency for ducks to defecate in water leads to open water sources quickly becoming fouled with droppings and high levels of bacterial contamination. Some research associates this with poor health in ducks, while other research does not. Contaminated water does, however, pose a problem for waste management, and treating this water may not comply with environmental-protection requirements.

Many studies have compared different methods of providing water to ducks to find a solution that is economic, hygienic and welfare friendly. Ducks prefer clean water to dirty water, and place a high value on water into which they can submerge their heads. While they will use deeper water for wading or swimming, these activities are of lesser value to ducks than head immersion, and the priority should be to provide them with water for bodily maintenance activities such as cleaning the eyes and nostrils.

Ducks in the USA are typically housed indoors on slats with access to nipple drinkers only, while ducks in the UK and Europe have access to litter and are required to have at least some access to open water. This access can be provided using features such as bell drinkers and



"There is a large body of scientific literature showing that access to open water is beneficial to duck welfare. However, providing this resource is an ongoing challenge for producers"

modified cup drinkers, although there are also options for troughs, baths and showers to be provided.

A number of studies have compared these water sources to determine which is best in terms of duck health and behaviour, although this has not resulted in any clear solutions. In one study it was found that ducks housed with intermediate-sized water troughs (20cm wide) used twice as much water as those given access to wider troughs (50cm), but these ducks had better foot health and the water contained less microbiological contamination than water in the wide troughs. It has also been found that when ducks are provided with simultaneous access to baths, troughs and showers, they spent a similar amount of time using each, with a preference for using the showers. However, these options still use large volumes of water and must be placed over slats or other areas with good drainage to avoid wet litter.

The development of modified drinking cups for use with ducks may offer a solution to many of these problems. These modified drinking cups (such as the **Pekino**, produced by Big Dutchman) contain a deep cup (10cm) in which the ducks can fully immerse their heads. A rim around the edge of the cup reduces the amount of water spillage, and water flow is maintained so that the cup does not empty during use. When compared to nipple drinkers, these modified cups have been associated with cleaner plumage and better eye and nostril health. When provided with cups by researchers, ducks showed a clear preference for the cups over the nipples, and used them to perform a wide variety of preening and drinking behaviours. The bacterial count was higher in the cups than in the nipple drinkers, but there were no negative effects on duck health reported. Unfortunately, foot health was still poor and this may have been due to excess water still reaching the litter.

These studies all emphasise the need for further refinement of the methods used to provide access to open water for commercial ducks.

In the meantime, some of the negative impacts associated with access to open water can be reduced by

- providing access to water over slatted flooring rather than litter to improve litter quality;
- restricting the duration of water access, although the optimal duration of access for duck welfare and good hygiene has not yet been determined (it is vital that water access is provided for long enough so that all ducks can access the water without undue competition);
- providing access to water through the use of modified cup drinkers, possibly in combination with restricted durations of access to reduce the risk of wet litter.

As the global demand for duck meat and eggs increases, so too does the need for a solution to this problem. An optimal farming system is one that can provide ducks with access to open water so that they may fulfil their behavioural requirements to ensure good welfare, and in a manner that is economical and ensures good flock health for the producer. This dilemma has existed for over 20 years, however, research in this area is increasing, and the development of targeted commercial products (such as modified cup drinkers) are promising developments. PD

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Corn vs wheat: which diet results in happier, healthier quails?

Words Matthew Wedzerai

Due to an increased demand for quail as both a laboratory and farm bird, transporting quails between laboratories or farms and slaughterhouses has become widespread – but this may have a negative impact on welfare and productivity. Could enzyme supplements in the birds' diets help reduce stress after transportation?

Although several studies have been carried out assessing the role of diet in managing stress in chickens, only a few have been carried out on quails to evaluate the importance of nutrition supplementation for reducing transportation stress. In 2016 one such study was conducted to examine the effects of two major sources of energy in poultry nutrition on reducing transportation stress: the capacity of a corn-based diet was compared to a wheat-based diet supplemented with xylanase and phytase on reducing stress after transportation. To evaluate the capacity of these diets, different immunity parameters were measured, and the effects on welfare and productivity are outlined below.

The effect of transportation on stress

During transit, birds may be exposed to an array of potential stressors including thermal extremes, acceleration, vibration, motion, impacts, feed and water deprivation, social disruption and noise. Most studies indicate that high ambient temperature is a major factor in the elicitation of physiological stress responses during road transportation. Moreover, these adverse effects become even more significant when transportation takes place under abnormal environmental conditions, or when adequate time is not allowed for the birds to adapt to confounding physiological changes.

How stress affects quail welfare and productivity

The act of being loaded and transported is likely to be novel to the birds, and thus may heighten fear-related behaviours. High mortality, decreased meat quality and reduced welfare due to heat stress have been recognised as the most common problems encountered during transportation in poultry. The consequences of these detrimental stimuli may range from mild discomfort and aversion to death. In experiments, it has been indicated that 40 percent of "dead on arrival" birds die as a result of stress (Bayliss and Hinton, 1990), and that the mortality rate rises as the transportation length increases (Warriss et al, 1989).

Why wheat and why supplement with xylanase and phytase?

Especially in wheat, the enzymes xylanase and phytase are expected to release nutrients through better digestion – lowering the viscosity of the digesta. Increased viscosity limits nutrient digestion in the foregut in two ways: directly by lowering the passage rate of digesta and reducing the exposure time of digested nutrients to the gut wall, and indirectly by provoking microbial fermentation and the proliferation of microflora.

A proliferation of microflora in the small intestine might decrease the digestion of fat and fat-soluble vitamins. Studies have shown that diets with a balanced concentration of vitamins could reduce the effects of fear responses (Kidd, 2004).

The lower increment in heterophils (Table 2) in wheat-based diets might be related to the higher content of some minerals, such as copper, zinc and selenium, in wheat grain. Studies (Yerturk et al, 2008) have demonstrated that supplementing the diet with copper, zinc or their combination could ameliorate transport stress (as well as stress caused by different environmental factors) based on higher final live weights and egg weights. In addition, it has been reported that adding dietary selenium could improve feed efficacy and increase antioxidant activity, and might restrict changes in blood biochemical parameters (Fan et al, 2009).

Parameter	Corn-based diet *On arrival*	Wheat-based diet *On arrival*	Corn-based diet *After 24 hours*	Wheat-based diet *After 24 hours*
Heterophil (H) (%)	49.1	49.6	51	51.2
Lymphocyte (L) (%)	46.9	42.4	47	44.3
H:L ratio	1.047	1.17	1.096	1.157

TABLE 1 | *H counts, L counts and H:L counts immediately on arrival and 24 hours after transportation (journey time: 100 minutes)*

Dietary group	Parameters	On arrival	After 24 hours	Difference
Corn-based diet	Heterophil (%)	49.1	51	1.9
	Lymphocyte (%)	46.9	47	0.1
	H:L ratio	1.047	1.096	0.049
Wheat-based	Heterophil (%)	49.6	51.2	1.6
	Lymphocyte (%)	42.4	44.3	1.9
	H:L ratio	1.17	1.157	-0.013

TABLE 2 | *Differences in H counts, L counts and H:L ratios between the two blood samplings immediately on arrival and 24 hours after arrival following transportation (journey time: 100 minutes)*

The trial

The trial setup was as follows:

- there were 15 birds per treatment (corn and wheat-based groups);
- birds were 35 days old;
- birds were randomly chosen from each group and were subjected to catching, handling, crating in boxes (five birds per box), loading and transporting for a journey of 80km (lasting approximately 100 minutes);
- at the end of transportation, quails were housed in battery cages (five birds per cage);
- immediately on arrival, transported quails were restrained separately and blood was collected in order to check immune parameters.

The results

To characterise the responses of birds to transportation, such as behavioural and physiological responses, the study focused on the heterophil-lymphocyte (H:L) ratio. Most research has shown that heterophil-lymphocyte ratios will increase after road journeys, which makes it a more valuable index of stress in poultry, i.e., an indicator of the perceived magnitude of stressors than plasma levels of corticosterone in avian species.

Immunity parameters

Immediately on arrival, the H counts were lower for corn-fed quails than for the wheat-fed group. The L counts were higher for quails that had been fed a corn-based diet compared to those whose feed was wheat based. Moreover, the H:L ratios were higher for the wheat-fed group (1.17 percent) compared with corn-fed quails (1.047 percent). These results indicated that feeding quails with corn-based diets could help the birds to cope better with transportation stress immediately after transportation, resulting in fewer physiological responses compared to quails that were fed wheat-based diets.

However, after 24 hours, the two groups showed different results (Table 2). The wheat-fed group demonstrated a lower increment of H counts than the corn-fed group. It is obvious that for a group to have lower H:L ratios after 24 hours of transportation, H and L counts should decrease and increase respectively, and this is a better indicator of overcoming stress. In addition, the H:L ratios decreased over 24 hours in the wheat-fed group in comparison with the corn-fed group in which the ratios rose –and this finding indicates that a wheat-based diet enables quails to overcome stresses with fewer physiological responses. However, these ratios were still lower in the corn-fed group (1.096 percent) compared with the wheat-fed group (1.157 percent).

Concluding remarks

- A corn-based diet can help the bird to better resist transportation stress and lower physiological changes while confronting stressors.
- However, feeding quails a wheat-based diet supplemented with enzymes could have more positive effects in terms of coping with stress, due to the higher content of some minerals such as copper, zinc and selenium.
- Overall, a wheat-based diet supplemented with enzymes offers a better combination for improving quail welfare, nutrient utilisation and productivity, compared to a corn-based diet.
- Consequently, to lower severe transport-related stress, the authors suggested feeding quails with a corn-based diet in starters, then changing to a wheat-based diet supplemented with enzyme complexes in growers – or at least in finishers – to help the birds better overcome stress and fear responses after transportation. PD

"A corn-based diet can help the bird to better resist transportation stress and lower physiological changes while confronting stressors"

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What will Brexit mean for the British game sector?

Words Jim Webster

There is one obvious difficulty when trying to anticipate the effects of Brexit. Nobody seems to have any idea what Brexit will actually entail. Not only that but even with a formal deal is established, we will be entering the area of post-CAP UK agricultural policy and that is still undecided. Indeed, I don't think anybody is clear exactly what the position of the devolved administrations will be with regard to agricultural and rural policies post Brexit. It's possible that the effects could be felt differently in different parts of the UK. So, in assessing the impact of leaving the EU on the UK's pheasant farms and grouse moors, nothing is certain and we must consider a range of possibilities.

Looking first at outcomes for the grouse moors, they do not presently receive support from the EU's Common Agricultural Policy for the grouse-rearing operations themselves. But EU money might be provided to support a rural business which has a grouse-shooting element if it also has an agricultural enterprise. Hence we see The Guardian, among others, publishing articles that fulminate against "Grouse shooting estates shored up by millions in subsidies".

With Defra talking about "public money for public goods", this situation could well change for grouse-moor managers. After all, they are well placed to contribute to carbon storage and flood-risk alleviation - clear public goods which might attract government support. Similarly, grouse-moor managers can also take part in other environmental programmes. Brexit might inadvertently open the door to increased government funding for them. Whether this is politically acceptable is another matter. In theory paying these estates to provide public goods should be less politically sensitive than some of them indirectly drawing money from the CAP.

Some people have been worried that leaving the EU might reduce the numbers of visitors from outside the UK who want to come and shoot grouse. It's difficult to get figures for non-UK nationals, but in 2010 the Game Conservancy (now Game & Wildlife Conservation Trust) did a report on the economics of Scottish grouse shooting. Their survey data indicated that the amount of revenue drawn from overseas by grouse shooting was very small, and they did not include an estimate for it. In England the situation might be different with more foreign visitors coming in for the shooting. Yet these are by and large wealthy people, and it's difficult to see why they would stop coming as a result of Brexit.

One of the problems rarely considered outside the industry is the administrative issues shooters face if they want to bring their own shotgun into the UK for shooting. At the moment the large shooting estates are on top of this and know their way through the procedure. Whether leaving the EU would involve a change in firearms regulations is very difficult to predict. Still, if it were possible to bring shotguns in, the large shooting estates would doubtless continue to organise this service for their clients. There again, given a proposed EU Firearms Directive, rushed out in the days after the Paris attacks of November 2015, it might be that the UK, outside the EU, could become the perfect place for a continental sportsman to store his shotguns, thus making us a more tempting destination.

Looking at pheasants, the situation is different. In 2016 we imported 5,861,823 live pheasants and 9,591,696 hatching eggs. Approximately 90 percent of the live birds and 80 percent of the eggs were from France.

The Game Farmers' Association estimates that 50 percent of pheasants and 70 percent of partridges released in the UK have their origin in other EU member states. Most are imported as eggs or day-olds (probably half and half). A few come over at the poult stage but not many.

When - or if - we leave the single mar-

“When - or if - we leave the single market, the trade in birds and hatching eggs from the EU might be disrupted”

ket, the trade in birds and hatching eggs from the EU might be disrupted. The two main possible causes of disruption of this trade from the EU to the UK are the introduction of tariffs and the introduction of new, stricter, phytosanitary arrangements.

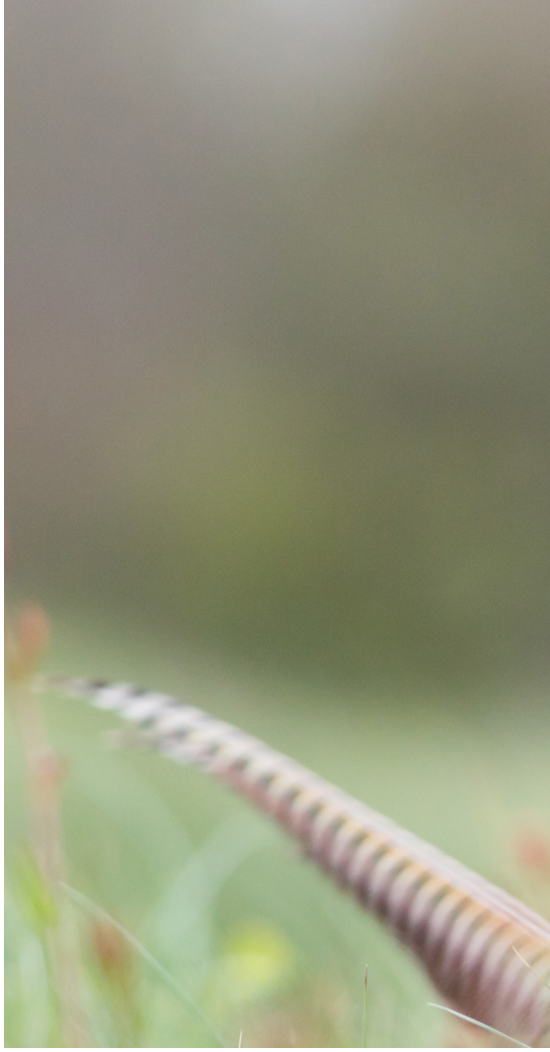
If the government does impose a tariff on these imports, or finds some other way of blocking them, this could have two effects. Firstly, it might provide a business opportunity for UK-based pheasant farms. Secondly, we could see prices go up, at least in the short term. It’s unclear whether this would have much effect on the willingness of shooters to pay to shoot the somewhat more expensive birds.

But increasing the cost of pheasants might have another knock-on effect. A lot of smaller shoots manage to avoid VAT registration. These are mainly family shoots which sell three or four days of shooting to help recoup their costs. Increased costs would likely push some of them into VAT registration at which point they have to charge an extra 20 percent. This may force them to adopt a more commercial attitude to compete, which will require that they have shift to the model of charging per bird and bringing more birds into their operations. While these more commercial shoots might be excellently run, there is always the danger of overstocking around the release pens. If things get out of hand here the young pheasants can take out the entire understory layer leaving nothing but trees growing out of bare dirt.

A final issue to consider is antibiotics. The BVA, Game Farmers’ Association, National Gamekeepers’ Organisation, Game Feeds Trade Association and RUMA have come up with a new best-practice procedure for prescribing antibiotics to game birds. The industry coped with the loss of Emtryl, and antibiotic usage is down. The Veterinary Medicines Directorate endorsed figures which were released in October 2017. These showed antibiotics saw a 36 percent voluntary reduction in game-bird rearing in 2017 compared with 2016. There was also a 53 percent reduction in antibiotics administered in feed given to the birds.

Finally organisations such as the League Against Cruel Sports and similar bodies have also spotted an opportunity with Brexit. They are contemplating changes that might be made possible by leaving the EU and are already cranking up their lobbying. PD

Making life pleasant for pheasants



Words Chris McCullough

Thanks to increasing oversight and clearly codified regulations, pheasant welfare has improved significantly in the UK in recent years. But compared to other pheasant-rearing countries such as Australia, are British pheasant farms ahead of the game?

Pheasant farms attracted a bad reputation around ten years ago when poor welfare practices were exposed, but gallant efforts since then to improve the sector seem to be working.

Back then, reports emerged of pheasants being kept in overcrowded conditions before they were being released for shoots across the UK. In 2013, the UK government drew up a set of regulations for managing the habitats in which pheasants reared for sporting purposes were kept. The regulations followed research by the Farm Animal Welfare Committee and were drawn up as the official Code of Practice for the Welfare of Gamebirds Reared for Sporting Purposes. Failure to follow these welfare codes was deemed an offence.

The code states that gamebirds reared for shoots must:

- have an environment appropriate to their species, age and the purpose for which they are being kept, including adequate heating, lighting, shelter, ventilation and resting areas;
- have ready access to fresh water and an appropriate diet to maintain growth, health and vigour;
- be provided with appropriate space and facilities to ensure the avoidance of stress and to allow the exhibition of normal behaviour patterns;
- be provided with company of their own kind as appropriate for the species concerned; and
- be adequately protected from pain, suffering, injury or disease. Should any of these occur a rapid response is required, including diagnosis, remedial action and, where applicable, the correct use of medication.

Routine inspections are carried out by the Animal and Plant Health Agency who enforce the rules. The agency also investigates complaints and can bring prosecutions where necessary.

Since the Code of Practice was drawn up there has been a reduction in the number of welfare issues among pheasant farms, which is good news according to the Game Farmers' Association (GFA). The association represents game farmers throughout the UK and has around 250 members. Its political adviser, Charles Nodder, says that standards are continually improving.

"Pheasants and partridges reared in captivity are safeguarded by general animal welfare laws but in addition, each of the UK home nations now has its own government Code of Practice for the Welfare of Gamebirds Reared for Sporting Purposes," says Nodder.

He continues: "These codes specifically cover all the main processes in game bird rearing, setting standards that must be adhered to and providing appropriate guidance.

"They were written by government vets and are advocated throughout the sector. For example, in order to join the GFA, members are required to rear their game birds in accordance with the government code applicable where they operate.

"Although game rearing is often picked on by animal rights campaigners because of its association with shooting, which they do not like, incidents of poor welfare in game birds are actually few and far between.

"Over a typical period a few years ago, of all complaints made by the public to the RSPCA only one in 2,000 concerned game birds," he adds.

With the threat of avian influenza ever-present, game farms must be on their guard to protect pheasants from contact with wild birds.

Guidelines stress that breeders keeping 50 birds or more must provide details on the species of bird, the husbandry system in which they are kept, the number of species usually kept and the number of birds that have access to open air, as well as details on seasonal stocking variations and nearby open water.

“There is no doubt rearing and shooting game birds for sporting purposes is big business in the UK, contributing over £1.6 billion to the economy each year”

Breeders must adhere to all the usual biosecurity rules to avoid contact between their flocks and wild birds. They must also notify the authorities if there are any changes in stocking rates by an increase or decrease of 20 percent.

The pheasant-hunting season in the UK runs from 1 October to 1 February, with the exception of Northern Ireland where the season ends on 31 January.

There is no doubt rearing and shooting game birds for sporting purposes is big business in the UK, contributing over £1.6 billion to the economy each year. Figures state there are around 40 million game birds, between 30 million and 35 million pheasants, reared and released for shooting in the UK annually.

Although there are around 400 game farms in the UK, around 40 percent of the pheasants reared are imported, mostly as hatching eggs, with a smaller number of day-old chicks from France.

Game bird farming is also becoming quite a boom industry in Australia, and even though quail is the number one bird in terms of demand, pheasants are also popular there with consumers, restaurants and shoots.

With Australia’s range of habitats and climatic conditions, the guidelines for rearing game birds differ somewhat to those in the UK. In Australia, for example, it is typical to house pheasant breeding stock in individual mating groups and, though to a much lesser extent, to allow them to range in larger populations in outside runs. Pheasants are provided with areas for flight in either large aviaries or netted pens. Alternatively, they may be grown in open pens if one of their wings has been clipped to prevent them from flying away.

The way in which breeding stock is housed will be governed by the size and structure of the enterprise, the land available, the purpose of breeding (colony breeding or selective breeding) and the type of market for which the pheasants are being reared. For example, regulations for selective breeding require that single males are housed with up to six females, or that paired birds are housed individually.

Australian pheasant producers use turkey crumb to feed their birds if they cannot source specifically formulated pheasant feed, due to both bird types having similar nutritional requirements.

Authorities in Australia offer guidelines to producers to help them react if and when diseases such as coccidiosis and blackhead occur. If outbreaks of these diseases are widespread, preventive drugs can be added to the ration. Alternatively, outbreaks can be treated with drugs in the drinking water.

A good on-farm hygiene programme is encouraged by the authorities to help keep disease outbreaks to a minimum. These include cleaning pens out often, avoiding dampness in the pens, distributing fresh litter or sand around the floor of the sheds and isolating diseased birds from the rest of the flock. PD

Introducing...

The Common Pheasant

Words Ryan Johnson

Native to Asia, the **Common Pheasant** was introduced into the UK and naturalised there in the 11th century CE, but it has been hunted elsewhere – along with other game birds such as grouse, partridge and even peacocks – since the Stone Age. The Common Pheasant has since been introduced as a game bird or naturalised across North America, Europe, New Zealand and Japan.

Their diet consists of grubs, insects, shoots and seeds. They are found mainly on the forest edge but may also be found on farm and grasslands. Both males and females sport the characteristically long tail of the pheasant family of birds, but it is the males who have the most dramatic colouring.

Pheasants are often farmed rather intensively owing to their inevitable release as game birds, but welfare standards on-farm are due to improve.

Did you know?

Pheasants, likely owing to their dramatic appearance, were among those birds which the Roman emperor **Caligula sacrificed** in a temple he built to honour himself. In fact, pheasants have typically been a part of opulent feasts and displays of wealth, often being hunted throughout history by the wealthier classes in particular. This too may be traced back to Roman times, where **Pliny the Elder** in his *Natural History* writes "Aethiopia [*sic*] and India, more especially, produce birds of diversified plumage, and such as quite surpass all description. In front of these is the phoenix, that famous bird of Arabia." Pliny describes the bird as having golden plumage around the neck with a purple body and azure wings. Historians remark that indeed this description refers to an actual bird, but that bird is rather the **Golden Pheasant** native to the interior of Asia.

Perhaps not the immortal bird of fabulous tales, but impressive nonetheless!

Have a look at the feature articles in this issue of *Poultry Digital Magazine* for more information on pheasant welfare and its outlook going forward. PD

YOUR QUESTIONS

Poultry professional Mike Colley answers the best questions from The Poultry Site community

Got a question? Email **newsdesk@5mpublishing.com** | Twitter **@thepoultrysite** | Facebook **/ThePoultrySite** | Forum **forum.thepoultrysite.com** | Post Unit 10, Southill Business Park, Cornury Park, Charlbury, Oxford, OX7 3EW

Q: I'm thinking about raising ducks. Is there anything I need to know that's different from raising chickens?

A: Ducks are a fantastic and comical alternative to chickens; you also have the added benefit in that they tend to be quieter. Drakes don't crow at 4 am and wake your neighbours. On the downside they need lots of water, which unfortunately goes in the front and out the back rather quickly. Duck eggs are great as well, and because most duck eggs are produced in relatively good welfare conditions they are my preferred choice at the supermarket.

If you have successfully raised chickens you will have little problem with ducks. You can get special duck feed but I have found ducks are very forgiving and a standard poultry diet will suffice – just check with your supplier. You need to be careful, though, that they don't contain medication such as coccidiostats (CDS) which can be fatal to ducks and geese.

Water is the key to successful duck raising. They must be able to submerge their heads, otherwise they will suffer eye infections. Water will need to be kept clean and changed regularly; you might find that it is easier to set up a showering area over some smooth, round gravel where the water can run out of the enclosure. If you just ran it for a short while each day the ducks would thoroughly enjoy themselves.

Q: I have a broody hen with three-day old chicks. The hen is a great mum but come into the coop at night, even when it's raining and windy. I'm worried about vermin getting at them so I moved her into the coop which caused all sorts of trauma for her and her chicks. Any advice?

A: You are right to be concerned about predation and weather. This, however, is not unusual behaviour. In fact, in a wild situation, once hatched the mother and chicks would be unlikely to ever return to the original nest. If you can find some old pictures of broody coops from the first half of the 20th century you will see that the hen box has a slatted front, this is to prevent the hen from leaving the nest section but allowing the chicks to explore outside and return when she calls or they want her security and warmth. Moving a broody hen will always upset her and there is a high risk chicks will be trod on, or get lost in the commotion. Generally speaking, using broodies for small numbers of chicks is ideal and often more successful than artificial means. One just has to be careful of a few things; the greatest risk of using a broody is disease transfer, so treat her for lice, mites and worms. She needs to be in good health so encourage her to eat and drink during the 3-week sitting period, literally taking her away from the nest for 15 minutes to eat, drink and poop if she is not doing this under her own volition. Depending on the age of the eggs, they are fine being left while the hen attends to her personal needs. Keep the nest area clean, broodies do extra-large poops and often smear them on the eggs, so remove droppings during your daily checks.

Q: From your perspective, what are the advantages and disadvantages to the Salatin-style "chicken tractors" for pastured broilers?

A: The structure and size of the unit is adequate, but could do with an integral roosting house to protect birds from drafts and driving rain. The availability of pasture in the pen area means it wouldn't meet any commercial standards such as RSPCA Assured or Soil Association, so you could not market the meat as free-range or organic. Chickens love to eat grass and herbs and certainly will act as mowers, but the grass must be 2-3 inches maximum length, as an excessive amount ingested is likely to cause digestive blockages. Long grass is fine if birds are not desperate to gorge themselves on it. Other vegetation of the broadleaved type is great, so you may consider modifying or enriching the pasture. The vegetation can only make up a proportion of the diet though; you would still need to allow access to a good quality pellet or mash. Badgers and Foxes will need to be kept away for a rigid cage you would need very even ground to prevent escape. As with grazed animals, pasture is only of value when it's growing. Personally, I would not rear broilers outside in the winter on a small scale as there is not enough shared warmth at night and the vegetation is not growing. PD

Mike Colley

Mike has had an interest in all things chicken since he first asked his mum on the school bus "what colour eggs do different coloured chickens lay?" aged five. Over the next 45 years Mike developed his knowledge of poultry: in his backyard, breeding, hatching, showing and selling chickens, as well as in the commercial poultry industry as an Area Manager and, latterly, a Research Manager.

EVENTS

Poultry events from around the globe

Chicken Marketing Summit
Date: 22-24 July 2018
Location: Orlando, Florida, USA

Don't just survive. Thrive! The 2018 Chicken Marketing Summit will provide attendees with the tools they need to react to disruption in the poultry marketplace. Teaching you to do more than just react, industry experts will offer insights for how to improve your business and overcome the disruption.

www.wattglobalmedia.com/chicken-marketingsummit/

2018 PSA Annual Meeting
Date: 23-26 July 2018
Location: San Antonio, Texas, USA

Covering topics from the state and future of the poultry industry to production efficiency, this event will cover a broad range of topics including alternative production practices, amino acids and performance, and the poultry of the past.

www.poultryscience.org/psa18/

7th International Poultry & Livestock Expo
Date: 31 August-2 September 2018
Location: Bangalore, India

Media Today Group is organizing 7th edition of "INTERNATIONAL POULTRY & LIVESTOCK EXPO 2018", an international event, concurrently with the 8th edition of DairyTech India 2018 and 10th Edition of AgriTech India 2018 from 31 August-2 September 2018 at BIEC, Bengaluru, India.

www.iplexpo.com

Arkansas Nutrition Conference
Date: 11-13 September 2018
Location: Rogers, Arkansas, USA

The Arkansas Nutrition Conference is an annual educational event and is coordinated by the Feed Manufacturers Committee of The Poultry Federation.

www.vet.uga.edu/pdrc/conference

KYOTO | *The IEC Global Leadership Conference Kyoto 2018 is being takes place at the IEC Kyoto, Japan from the 9th to the 13th of September 2018*

SPACE
Date: 11-14 September 2018
Location: Rennes, France

SPACE is the world event for all professionals of livestock production: cattle (milk and beef), poultry, pigs, ovine, goats, rabbits and aquaculture.

uk.space.fr/EN/VisiterEn.aspx

IEC Global Leadership Conference Kyoto 2018
Date: 9-13 September 2018
Location: IEC Kyoto

The IEC Global Leadership Conference gathers CEOs and leaders from the IEC's 300 member companies. These companies represent 80 countries and all business areas of the egg industry. The IEC's mission is to bring together the most influential leaders in egg production and egg processing in pursuit of efficient business practices and positive change across our industry.

https://www.internationalegg.com/events/iec-global-leadership-conference-kyoto-2018-2/

VIV China
Date: 17-19 September 2018
Location: Nanjing, China

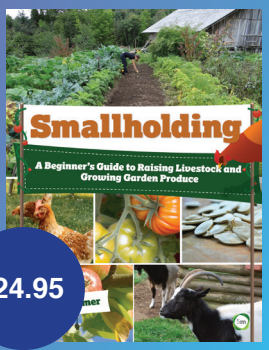
National and international exhibitors at VIV China 2018 will represent their solutions and innovations within the Feed to Food chain.

www.vivchina.nl/en/Bezoeker/About-VIV.aspx

XVth European Poultry Conference
Date: 17-21 September 2018
Location: Dubrovnik, Croatia

The conference will be structured around plenary meetings, workshops, a poster session and an exhibition, as well as technical tours giving an overview of various relevant developments in the area of poultry science. The scientific programme of the XV European Poultry Conference has been developed in collaboration with the Chairmen of the Working Groups of the European federation of WPSA.

www.epc2018.com



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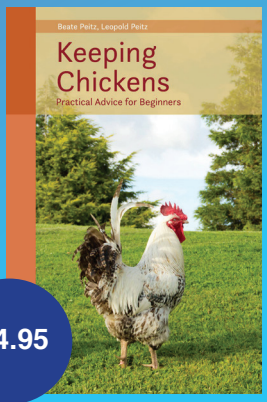

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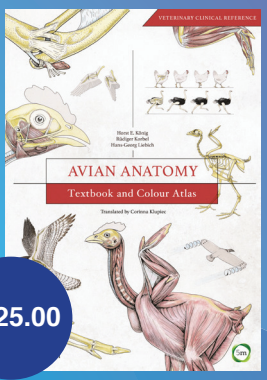

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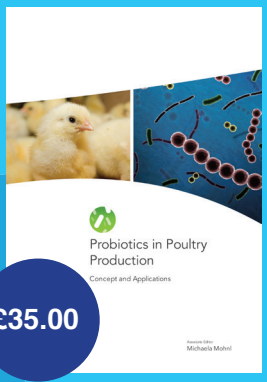

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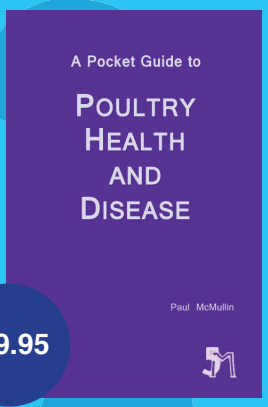

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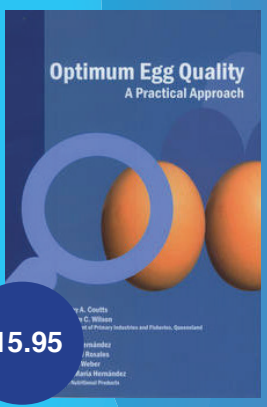

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