



**A Nuffield Farming Scholarships Trust  
Report**

*Award sponsored by*

**Three Counties Agricultural Society**



**No antibiotics ever – an option  
for the UK poultry industry?**

**Sophie Edenborough**

**July 2015**

**NUFFIELD UK**

## **NUFFIELD FARMING SCHOLARSHIPS TRUST (UK)**

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# A Nuffield (UK) Farming Scholarships Trust Report



Date of report: July 2015

*"Leading positive change in agriculture.  
Inspiring passion and potential in people."*

Title	No antibiotics ever – an option for the UK poultry industry?
Scholar	Sophie Edenborough
Sponsor	Three Counties Agricultural Society
Objectives of Study Tour	The study tour aimed to investigate practices and procedures used by poultry meat producers around the world that have enabled them to either reduce or remove antibiotics from their production programmes. This would facilitate ideas being brought back to the UK for poultry farmers to utilise in order to reduce their antibiotic usage.
Countries Visited	The Netherlands, Brazil, United States of America
Messages	<p>The use of alternatives to antibiotics should be considered with an open mind and continual water sanitation is also important.</p> <p>The removal or reduction of antibiotics from poultry production needs to be approached in a strategic manner, analysing the risk areas and putting solutions in place to avoid those risks.</p> <p>Each farm will have individual requirements for enabling it to reduce or remove antibiotics and the programme should be specifically tailored for that farm. UK poultry producers should be aware that one programme is unlikely to work across a range of growers.</p> <p>UK poultry producers need to see any changes to legislation or producer requirements as an opportunity to assess and improve upon existing production practices.</p> <p>"No antibiotics ever" is not the only option for the UK poultry industry. Antibiotics should be available if necessary to prevent spread of disease and to protect bird welfare.</p>

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## 1.0. Executive Summary

Over the last few years there has been a growing public and media interest in the threat to public health from the development of resistance to antibiotics. Resistance to antibiotics is a problem in both human medicine and agriculture alongside the possibility of transfer of resistant bacteria between species. The development of antibiotic resistance cannot be eradicated but the rate of development can be slowed. Without functioning antibiotics the UK poultry industry will be at risk of disease and will be unable to prevent the spread of disease and infection. Therefore the UK poultry industry should look at the way it uses antibiotics and try to preserve their efficacy to ensure antibiotics remain an option for disease treatment.

The aim of this study tour and report was to establish what drives changes to the way in which poultry farmers use antibiotics - Is it legislation or market demand? The study also wanted to determine exactly what poultry farmers were doing at farm level that enabled them to produce birds with little or no antibiotics. For this report visits were made to the Netherlands, the United States of America, and Brazil. The US was visited to see its companies producing antibiotic-free poultry meat for the retailers and the professionals involved in making this happen; Brazil to examine changes that companies made to their production practices to enable them to export to Europe; and the Netherlands to examine the effects of enforced legislation to reduce antibiotics.

There are a number of key areas that poultry production companies and farmers need to consider when assessing their options for reducing or removing antibiotics. Alternatives to antibiotics should not be overlooked but approached with caution and what works on one farm may not produce the same results on a different farm. Ensuring good quality water is available to the birds is highly important with a number of producers utilising systems that enable continual water sanitation throughout a crop. Each farm should be assessed individually for its risk points (when it normally uses antibiotics) and procedures put in place to reduce the risks.

Poultry production companies need to be aware that individual farms may require different approaches to aid reduction or removal of antibiotics and it is unlikely that one programme will work for all their growers. If legislation is going to be changed to affect the way UK poultry producers use antibiotics then these changes should be brought in slowly to give the industry time to adjust and adapt. This will ensure that bird welfare is not put at risk.

UK poultry producers need to see any legislative changes or producer requirements for less or no antibiotics as an opportunity to assess and improve their production practices. It also needs to be understood that “No antibiotics ever” is not a viable option and that antibiotics should be available if necessary for disease control and bird welfare.



## 2.0. Personal Introduction

I am not from a farming background and up until a few years ago most people who knew me would have been very surprised to hear I was forging a career in the agricultural industry. However, after completing my undergraduate degree in Anatomical Science with Veterinary Anatomy at Bristol University I returned home to Shropshire and took up a position at Liquid Mineral Services.

The business primarily manufactures liquid mineral and vitamin blends supplemented to dairy cows via the drinking water using our bespoke automated dosing system. For the first three years of my employment I gained experience about the dairy industry, nutrition, logistics, and management to name a few, whilst at the same time completing an MSc in Veterinary Physiotherapy at Harper Adams University. Upon completion of my dissertation I vowed never again to undertake anything akin to writing a 10,000 word report in my spare time around a full time job!



Figure 1. The author, Sophie Edenborough

After finishing my Masters degree I had to make a choice about where my career was heading, whether to continue in the agricultural industry or change my path to practise as a Veterinary Physiotherapist. I chose to stay working in agriculture as I believed it to be an industry that would continue to thrive in the future and I wanted to be part of a progressive industry that exists primarily in order to feed the world.

Approximately three years ago the company was given the opportunity to look at adapting our dosing system to enable us to provide water sanitation systems for poultry farmers. I was involved with this process from the beginning and I am now the Poultry Director of Liquid Mineral Services. The water treatment system was designed as part of a larger poultry management programme that was devised in America to enable poultry producers to grow chicken without the use of antibiotics. From this I developed an interest in how we use antibiotics in the poultry industry and why we use them. After learning about how you can utilise the birds' own intestinal health to reduce the requirement for antibiotics I wanted to find out more about other ways and alternative products that could be utilised to reduce the UK poultry producer's requirement for antibiotics. Combining this with a late onset desire to see more of the world led me to apply for a Nuffield Farming Scholarship.

Aside from my work I am also a keen show jumper and compete at national events around the country on a regular basis. I live in South Shropshire in close proximity to both my parents and my brother but travel all over the country as part of my current position at LMS.



### 3.0. Background to study subject

It has been very rare over the last couple of years for a week to go by without one of the daily newspapers publishing an article about antibiotic resistance, whether in human medicine or agriculture. In March 2013 Dame Sally Davies (Chief Medical Officer for England) stated that the threat of antibiotic resistance (ABR) was as big a risk to the UK as terrorism.

Whilst a large proportion of the issue is related to the misuse of antibiotics in human medicine the use of antibiotics (AB) in agriculture also has its part to play. Currently there are mixed opinions on what effect the use of AB in agriculture has on the development of ABR in human medicine but the UK media continues to print articles publicising any potential links to the livestock industry.

#### The Telegraph

Home Video News World Sport Finance Comment Culture Travel Life Women Politics Investigations Obits Education Science Earth Weather Health Royal Celebri

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#### Antibiotics given to farm animals could pose super-bug risk, minister admits

Powerful antibiotics given to farm animals could pose a threat to human health by increasing the risk of super-bugs, a Government minister has said.

BBC

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TV

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#### NEWS

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Science & Environment

#### Concerns grow over farm drugs used like 'sweets'

By Matt McGrath  
Environment correspondent, BBC News

© 28 May 2014 | Science & Environment

Figure 2: Examples of headlines in the media of the role of AB use in agriculture and the development of ABR in human medicine.

Within the agricultural press there were also many articles about the way in which the levels of AB in agriculture have been reduced in other countries such as the Netherlands and Denmark. The Netherlands has reported a reduction of over 50% in their AB usage in the broiler industry over a four year period. This, combined with the companies in America that are producing antibiotic free (ABF) chicken for the retailers, piqued my interest. If other countries were able to reduce their usage, or remove AB completely from their broiler programmes then what were they doing that enabled them to do this?



The UK poultry industry receives constant pressure on a number of different issues, which include the use of AB. Therefore I wanted to try to find some solutions that may help producers take steps to reduce their AB usage or, alternatively, place them in a position where they would be able to adjust quickly to any potential changes in legislation. In particular I was keen to find out what was being done at broiler farm level that was producing the desired results.

Although there has been a threat for many years that UK poultry producers would be forced to either reduce or cut out their usage of AB there were not, at the time of commencing this study, likely to be any immediate changes. However, with all the pressures on the industry from government, the EU and the media it is strongly expected that there will in the future be some legislative changes to the way in which the UK agricultural industry uses AB.

It is this scenario that drove me to try to equip UK poultry producers with the tools they needed to deal with any changes that may come.



## 4.0. Study Tour

### 4.1. The Netherlands

Two trips were undertaken to the Netherlands, the first in May 2014 and the second in November 2014, to follow up on leads from the initial visit. The Netherlands is a country that has undergone huge changes to the legislation surrounding the use of AB in the agricultural industry. Since 2009 they have reduced the total use of AB in the broiler industry by over 50%. The aim of the visits was to establish how this reduction had been achieved from the perspective of the poultry farmer and the veterinarian.

### 4.2. Brazil

Two weeks were spent in Brazil during August 2014. I wanted to visit a country that was not exposed to the same consumer pressures as poultry farmers are in Europe. Although Brazilian poultry producers are not particularly restricted on their AB usage when producing meat for domestic consumption, if they wish to export to Europe they have to abide by EU regulations for poultry production. Therefore, by visiting companies that were looking to export their produce to Europe I could ascertain what changes they were making to their production systems to enable them to produce poultry without low level AB in the feed. So although they were still using AB via the water therapeutically, they were not using AB as growth promoters, and therefore having to adapt their production programmes to compensate for this removal.

### 4.3. The USA

During January and February of 2015 three weeks were spent travelling in the US visiting Georgia, Arkansas and Pennsylvania. Although the US poultry industry has different legislation to that of the EU in that they are still using antibiotics in the poultry feed as growth promoters, not all companies were continuing to do this. The main purpose of this trip was to visit those companies that had taken a decision to produce poultry meat completely ABF (antibiotic free). I also wanted to visit industry professionals who were involved in this process to learn about the techniques and products they were using to facilitate this development.

### 4.4. The UK

Several meetings were held and a number of conferences were attended in the UK which included retailers, veterinary practices, the British Poultry Council (BPC), and poultry producers. I also attended a conference in Belfast on the Science of Antibiotic Reduction.



## 5.0. Why do we need to reduce our antibiotic usage?

### 5.1. Antibiotic resistance in human medicine

AB are used to stop the growth of or kill bacteria; however bacteria can develop resistance that prevents them from being affected by the AB. Resistant strains of bacteria can develop simply by chance mutations but using more AB can also increase the chance of resistant bacteria developing. The issue is that if the rapid development of bacteria resistant to AB continues, the numbers of difficult-to-treat infections will also grow and it will become more and more difficult to control infection in routine medical care situations. Resistance to AB can't be eradicated, however, it can be managed to try to limit the extent to which it becomes a threat to human health.

One of the main drivers for spreading resistance is the inappropriate use of AB. This is mostly the prescribing of AB without information about the nature of the infection or before the diagnostic test results are available. Another common misuse is not ensuring that the right drug is used at the right dose at the right time. If used in the wrong situation then it causes unnecessary AB exposure. It has been shown that up to 25% of English patients do not finish their course of AB and often keep them for use at a later date, something which encourages the development of resistance.

A large number of doctors indicate that many of their patients expect to be prescribed AB for a large range of illnesses, many of which are not caused by bacteria and therefore won't be helped by AB. Many doctors say that patients are often disappointed if they are not prescribed AB, some to the point of rudeness. Respiratory tract infection recovery is thought by patients to be enhanced by AB but this is not actually the case. Therefore, educating the public about AB and resistance is one of the key areas to tackle in order to reduce resistance development.

### 5.2. Antibiotic use in agriculture

There is an increasing amount of scientific evidence that suggests that the development of ABR is mainly the result of the misuse of AB in human medicine as opposed to their use in livestock. However, AB use in livestock production is still an important contributor to the overall resistance problem.

Currently there are thought to be three main mechanisms by which resistant bacteria that have developed from an animal source can become a threat to human health.

- The first is when a human can become exposed to resistant bacteria is by coming into direct contact with livestock or by ingesting meat or water contaminated with resistant bacteria.
- The second mechanism is the same as the above but then also involves the transmission of the resistant bacteria from human to human. This involves a break in the species barrier which allows the resistant bacteria to transfer within people.
- The third mechanism is by horizontal gene transfer where the resistant genes that have developed in the agricultural environment are introduced into human pathogens.



The current issue is that it is very difficult to assess and quantify exactly how much each mechanism contributes to the spread of resistant bacteria in human medicine. However, in the UK it is almost now accepted that the main driver for resistance in human medicine comes from the misuse of medication in surgeries and hospitals.

As well as the potential risk of the transmission of resistant bacteria from livestock to humans there is also the issue of ABR developing within livestock production. This means that AB that are used routinely to control disease within agriculture may start to become ineffective, as in human medicine. This is a problem within itself as, without functional AB, the UK agricultural industry may find it difficult to control disease and the spread of pathogens.

As can be seen from the information above there are many issues with the way in which AB are used and how this contributes to the development of resistance. It is hugely important for both human medicine and agriculture that the development of resistance is reduced by whatever means possible. Without plans to reduce resistance the situation may arise where humans cannot be protected from simple infections and routine procedures and operations may become very high risk and the agricultural industry may find it very difficult to control and prevent the spread of disease.

### 5.3. The current situation in the UK

Since this project was undertaken there have been a number of changes both to the way in which the UK poultry industry uses AB and to the views of industry professionals. As well as worldwide visits a number of meetings took place in the UK with retailers, veterinarians, and poultry producers, in addition to the National Farmers Union and the BPC.

In 2002 the alliance for the Responsible Use of Medicines in Agriculture (RUMA) was established. RUMA is made up of 24 organisations which includes the BPC and the British Egg Industry Council. The main message delivered by RUMA is that AB should be used “as little as possible and as much as necessary”. The way that RUMA encourages farmers to achieve this is by preventing disease, using the right medicine at the right time, trying to use older more conventional products that do the job just as well as the newer AB, and to move away from drugs that are critical for human medicine. RUMA tries to promote responsible use of AB through its guidelines and its comments on current issues.

In 2011 the BPC came to the decision that rather than wait for changes with regard to AB use to be forced upon the UK poultry industry, they needed to be proactive in readying the industry for any changes that may happen. The two main steps they took were to look at the current usage of AB in the poultry industry and to carry out a voluntary ban on the use of third and fourth generation cephalosporins and fluorquinolones, as they are AB considered important for human medicine. With regard to the usage of AB, data collection was started in 2011 with the data from 2013 being taken as the benchmark year. Data was collected for 85% of the total UK poultry production. The different sectors of the UK poultry industry are all looking at the way in which they use AB; the game industry is looking at usage with its prescribing vets, the egg industry has a new Lion Code which includes a mandatory requirement for recording AB usage, and the meat industry is using the Red Tractor and Quality British Turkey to monitor its usage.



In 2013 the Department of Health published its cross-governmental Five Year Antimicrobial Resistance Strategy. The foreword draws attention to the issue that there are little-to-no new AB being developed and therefore we need to act to ensure that we conserve the AB that are left. With regard to the agricultural industry the aim of the strategy is to encourage farmers to use AB responsibly. This has been aided by the addition of a requirement in the Royal College of Veterinary Surgeons' code of conduct that all veterinarians must use antimicrobials responsibly and, specific to the poultry industry, a voluntary ban by the BPC on the use of certain AB – that are critical for human health - in day old chicks. The strategy goes into detail as to the seven key areas for future action and how each sector involved can aid the strategy.

In early 2015 McDonalds made an announcement that in two years' time they wanted to sell only poultry meat that had not been exposed to any AB that were important for human medicine. This had a knock-on effect for UK poultry producers in that they were now being driven to remove certain AB from their production programmes.

One company that has already started looking at their use of AB is 2 Sisters Food Group who have a new policy in place with regard to antimicrobial strategy. The strategy for the group involves finding a balanced measure for AB use and implementing a framework for responsible use. The framework involves replacing AB with other interventions and not using medications critical to human health, reducing AB usage by utilising the Red, Amber, Green system and refining the strategy as progress is made. The target for the company is a 10% reduction per year (measured by defined daily dosage and mg/kg) between 2015 and 2020.

After understanding the current situation in the UK with regard to ABR usage and the poultry industry it became clear that although the situation in the future and any potential changes were not yet certain, the UK poultry industry may need to look at its practices with regard to a reduction in AB usage.

The aim of this study tour was to travel to other parts of the world to find potential systems and solutions that may aid the UK poultry industry in AB reduction.



## 6.0. Reducing antibiotics at farm level

There is huge variation in opinion and practices around the world when it comes to determining what it is that enables a poultry producer to raise birds with limited or no AB. The key areas to consider include biosecurity, the role of alternative products, the farm management, water sanitation, housing and equipment, and the overall approach.

### 6.1. Alternatives to antibiotics

There is a huge range of products available that are used as alternatives to AB. Attending the International Poultry Science Forum (IPSF) at the International Production and Processing Expo (IPPE) in January 2015 in the USA provided the opportunity to attend presentations detailing current research and trials from around the world on a wide variety of products. This included papers looking at the effects of probiotics, essential oil products, yeast extract products, and organic acids. Visits in Holland and Brazil provided evidence of a wide range of products used by farmers and veterinarians to reduce the amount of AB used on farm.

#### 6.1.1 Direct fed microbials

The chicken gut is made up of a community of bacteria, viruses, fungi and protozoa known as the gut microflora. They act to aid digestion by stimulating the gut and assisting in the breakdown of non-digestible components, stimulating development and maturation of the immune system, stimulating development and maintenance of gut tissues and protecting the gut from pathogens.

Products based on bacteria cultures can be utilised as prophylactic support for the chicken gut against pathogens and are often referred to as direct fed microbials or probiotics. These can either be non-defined bacterial products, usually containing over 200 species, or defined bacteria products of 1-10 species. Probiotics are defined as live microorganisms which, when administered in adequate amounts, confer a health benefit on the host.

One of the ways in which these products work is via competitive exclusion. By having an extensive healthy gut microflora the chicken is able to prevent any pathogens causing a problem. This is because the chicken's microflora provides competition for binding sites on the gut wall and for essential nutrients. They have also been shown to produce inhibitory substances such as organic acids or bacteriocins.

These types of products have been around for a number of years and have gained very mixed reviews as to their effectiveness. However, after attending the IPSF, it became obvious from the number of speakers presenting papers on direct fed microbials and competitive exclusion products that it is still not clear how to get the best out of these products. There is a huge range available utilising a wide variety of bacteria species (e.g. Lactobacillus, Bacillus Subtilis, Bacillus Licheniformis) and research is showing that the strain selected is important, as well as the point in the production cycle that it is applied.



The use of probiotics in America is discussed further on but the majority of companies visited were using either probiotics or prebiotics. Prebiotics are defined as non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth of one or a limited number of bacterial species. American legislation prevents the use of undefined cultures and therefore they are unable to use what are often described as competitive exclusion products.

In Brazil the most common products used were 'Acid-Pak', a combination of organic acids and probiotics, and Protexin. Acid Pak contains *Lactobacillus Acidophilus* and *Streptococcus Faecium*, and Protexin contains *Enterococcus Faecium*. Another company visited was producing their own probiotics in their lab.

In Holland one farmer was using a LoVit probiotic product which he administered at the start of the flock cycle. This product contains *Enterococcus Faecium* and Vitamins D and C. Another Dutch farmer was also utilising a probiotic that he fed to his birds at times of change or stress. The product was administered for three days at a time: when the birds first come in; when there is a change in feed; after vaccination; and at thinning.

The administration of probiotics for the first three days of a flock cycle seemed to be a fairly common practice. The other times at which probiotics are commonly utilised are following AB treatment or during periods of stress.

Although some UK producers have tried similar products with limited success the choice of product and point of application is the key factor and these products should be tried with consideration as to how best to utilise them.

### 6.1.2. Essential oils and natural remedies

In all countries visited there were farms or companies that were utilising essential oils or other natural products to aid bird health. Essential oils and natural remedies are also known as PhytoGenics. This is a group of additives that originates from leaves, roots, or fruits of herbs and spices. In general, plant extracts have been shown to have a number of antimicrobial and antioxidant properties but the research into their mode of action is not very advanced and it is not known exactly how they work and can best be utilised. This does not, however, seem to prevent poultry producers from administering these products. The two most common herbal alternatives that were seen during the study tour were garlic and oregano.

An interesting visit was made to a Dutch farmer based over the border in Germany. Although in Germany they were not under the same restrictions as poultry producers in Holland at the time, changes were being put in place from 1<sup>st</sup> January 2015 that restricts their AB use. What was interesting was that Mr Korenblik was utilising a variety of different natural remedies before resorting to AB. Mr Korenblik was working with a company that manufactured a range of products, mostly based on herbal components including cinnamon, garlic, oregano and thyme, and he was frequently trialling different products and different combinations of essential oils and natural remedies. Mr Korenblik was satisfied that the majority of the products trialled were successful and that part of this is due to him using them pre-emptively rather than reactively. Another Dutch farmer was using garlic regularly throughout his cycle, administering it through the water, once or twice a



week. He was doing it on the recommendation of his vet and believed that it was good for the bird's health.

The most commonly used phytogenic, though, was oregano. The main constituents of oregano are Carvacrol and Thymol. In Brazil one company was using Carvacrol oil in the finisher feed and believed it was one of the reasons they were getting better kill weights. They were not currently exporting to Europe but were preparing to and were using the Carvacrol oil to replace the growth promoter in the finisher feed.

It would seem that, although it is often unclear how phytogenics aid bird health and help reduce AB use, a number of producers believe there is benefit in using these products.

### 6.1.3. Organic acids

Organic acids are another group of alternatives to AB that have been around for a number of years and have been used with varying success. However, from this study tour it is clear that this group of alternatives to AB is being frequently utilised to try to aid gut health and bird performance.

There are two main ways that organic acids can benefit bird health, both of which are linked to the gut microflora discussed earlier. The first is that by feeding organic acids, either via the feed or water, you can provide a feed source for the bacteria in the gut helping to maintain a healthy and functioning microflora. The second is that by keeping the gut environment acidic it is inhospitable to any pathogens that may enter.



Figure 3. Photograph illustrating the range of organic acid products offered by a Dutch veterinary company



Throughout the tour there was evidence of a variety of different products composed of a range of organic acids being used. In Brazil the Acid-Pak product discussed earlier was used frequently, containing citric acid and sorbic acid, usually during the first few days of the cycle and then at times later on when the birds may be under stress, or after AB treatment. One of the common products used in Holland is Ultimate Acid, again at times when the birds are being exposed to challenges. Ultimate Acid is a combination of organic acids including formic acid, propionic acid, sorbic acid, lactic acid and acetic acid, and copper and zinc. Both of these are water-based products but there were also examples of organic acids being administered via the feed, the most common of which was butyric acid. Application of this varied between “the majority of the time” to “periods of stress”. For example one Brazilian company utilised butyric acid in the feed at days 17-28 of the cycle.

Quite often companies would be using products that were combinations of organic acids and essential oils. One of these products is Gallinat +, used by a company in Brazil, which is a blend of organic acids and essential oils. The product is fed at a low rate all the time, with the rate of application being increased at times of stress.

## **6.2. Water sanitation**

One of the common themes throughout this study tour was the importance of drinking water and how much of a role this has to play in aiding a reduction in AB use. Nearly all farms visited made some mention of the importance of drinking water when it came to practices that were looked at in terms of ABR. This included the incoming water supply, management of the drinking system and a variety of different sanitizers.

### **6.2.1. Hydrogen peroxide**

Products with an active ingredient of hydrogen peroxide have commonly been used for terminal hygiene. Many growers are now also utilising this product during the crop cycle. For example one grower in Holland who is using a number of different alternative water-based products such as probiotics and natural remedies always ensures that he follows this use with a hydrogen peroxide based product, Aqua Clean. He does this to try to remove any biofilm that may have built up, and this protocol was fairly common practice across Holland.

### **6.2.2. Chlorine**

The use of chlorine as a sanitizer during the crop cycle was probably the most common method of cleaning water seen throughout the visits, particularly in Brazil. Depending on the location and the pH of the incoming supply, the chlorine may be used in conjunction with an acidifier. In general the level of chlorine at the end of the drinking line was not always monitored but, where it was, most farms were targeting 1-3ppm of free chlorine. In some cases the chlorine was administered continuously, in others it was used either once or twice during a cycle, or sometimes once a week.



Figure 4. Image demonstrating the simple system used on Brazilian farms to administer chlorine as a water sanitizer. The two containers on the right of the picture are both adding products to the water - chlorine via one and a product to reduce condensation on the pipes in another.

### 6.2.3. Chlorine dioxide

Chlorine dioxide was predominantly seen in the US to provide continual sanitation throughout the flock cycle. The level to which these systems were monitored varied from company to company. As an example one company was monitoring weekly, carried out by the company's technical managers who were testing the levels of chlorine at the end of the drinking line. This was done using dipsticks with the aim being 1-2ppm of free chlorine. It was explained that part of the reason for regular monitoring was to ensure they were within target as anything over this becomes cost prohibitive.

### 6.2.4. Acids

Some producers also use acids to sanitise their drinking lines. Peracetic acid is the most commonly used organic acid for sanitation, usually used at terminal clean, although this was only seen on one farm in Holland. In America a few companies were using a product called PWT. This is a feed grade inorganic acid that sanitises the drinking system by keeping the pH very low, creating an inhospitable environment for pathogens.

### 6.2.5. Electrolysed water

A slightly less common method of water sanitation was seen in action during a farm visit in Holland, where Mr Timmer of Meerkerk had installed an Aquaiox machine. The machine acts to continually supply the birds with electrolysed water at an inclusion rate of 1.5%. Mr Timmer chose to do this as he wanted an assurance that his birds would be continually receiving a clean water supply and to aid



the removal of films and residues from the lines. The only concession he has to make is to switch the Aquaox machine off a day and half before he is due to carry out his water based vaccination. The installation of the machine was one of the changes that he made in his attempt to comply with the government's request for a reduction in AB. The machine works by electrolysis of purified water to provide a solution that is composed of hypochlorous acid. The hypochlorous acid produced is pH neutral, non toxic and super oxidised which means it helps to remove any bacteria from the water and has been shown to be effective against biofilm. The hypochlorous acid is generated by passing a saline solution through an electrolytic cell.



Figure 5. Image showing the Aquaiox machine supplying electrolysed water on a broiler farm in Holland

#### 6.2.6. Water quality and testing

Irrespective of the sanitation method being used either at turnaround or during the cycle, more and more companies were beginning to look at the quality of their incoming water supply.

In Brazil the water in general is fairly acidic, with even bottled water sold in shops having a pH of 5.2. This might explain why the majority of companies are able to use chlorine as a sanitiser on its own without the need for an acidifier. When hypochlorite is used as a sanitiser in water it dissociates into two components, a hypochlorite ion and hypochlorous acid. The hypochlorous acid is the superior sanitiser of the two and the ratio of one to the other is affected by the pH. The lower the pH, the more hypochlorous acid, the more effective hypochlorite is as a sanitiser. This is why in Brazil



chlorine is effective without the requirement of an acidifier. Some companies had farms in area where the incoming water supply has a pH of below 4. This is one of the reasons it is important to test and be aware of the quality of the incoming water supply as it can affect the sanitation method that you choose to use. For example in those areas with very low pH there would be a high risk associated with using acid based products that had to be administered via the drinking water.

As well as the pH of the water there are other components that need to be monitored and, if necessary, dealt with. Bacterial content is one of the key areas and this is why many companies have sanitation programmes in place. Along with this, mineral components of the water can also cause problems. For example, in the US, one of the companies visited explained that if they have high levels of iron or manganese in their incoming water then they look to install filter systems that will reduce those levels in the water. Another common system used in the US is UV filters which act to try to reduce the bacterial load of the incoming supply.

As well as monitoring the incoming supply it is also important to monitor the water in the drinking lines. Historically this has usually been done by taking samples from the end of the drinking line and testing for bacteria levels. This is something that Dr Susan Watkins's lab at the University of Arkansas regularly carries out. Dr Watkins also explained that they have moved on to also taking swab tests of the inside of the drinking lines as this gives a more comprehensive idea as to the condition of the poultry drinking system. Dr Watkins described how farms can have clean drinking water samples but still get issues associated with bacteria in the drinking water, which is often identified by the swab tests.

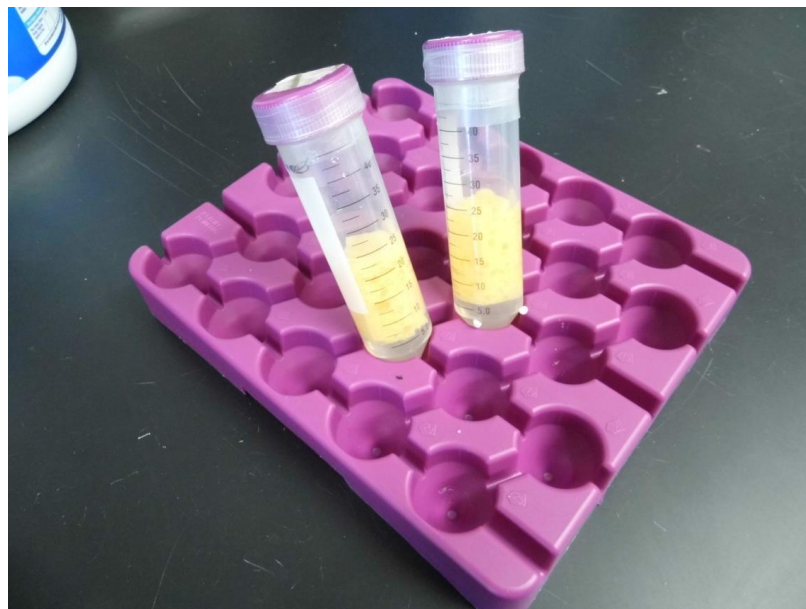


Figure 6. Photograph showing the test kits that the University of Arkansas send out to farms for swabs to be taken of the inside of the poultry drinking system



### 6.2.7. Continuous sanitation

As well as testing the incoming supply a number of companies were moving towards systems that enable them to sanitise the water continuously throughout the cycle, in addition to the intensive cleans carried out at turnaround.

A Dutch vet explained that, in Holland, historically the management of poultry drinking water had generally not been very good. In their efforts to reduce the use of AB this was one of the key areas that they focused on including improving terminal hygiene and looking at cleaning the drinking lines during the cycle, usually post administration of other products. One of the Dutch farmers visited explained that the next big change that he was looking to make was to his water system and he would ideally like an automated system that would supply his birds with clean water all the time.

Plainville Farms in the US are using a chlorine dioxide system that sanitises for the duration of the cycle; Mr Timmer in Holland has his electrolysed water machine and a number of companies in Brazil continually administer chlorine to the drinking water. It seems from the visits carried out that irrespective of the method chosen there is a move towards continual sanitation of poultry drinking water throughout the cycle, and a realisation that this is quite important for enabling a reduction in the level of AB used.

## 6.3. Biosecurity

Many biosecurity practices were common to all farms and companies visited around the world, although of the countries visited as part of this study tour, Brazil seemed to have the most stringent procedures in place. As part of their biosecurity programme several companies had a structure to the way their farms were set out across the country. The area which their farms covered is divided up into regions and the chicks are all placed at the same time in that region, ensuring that all the birds in each region are the same or very similar in age. Each region has its own technical manager and they are only allowed to visit farms in that region. This ensures no crossover between birds of different ages. If the farms are not divided by regions then the protocol is that technical managers must visit farms in bird age, starting with the youngest and finishing at the eldest.

Another feature very common across Brazilian poultry farms was the disinfectant wash for all vehicles entering the sites. Although some farms in the UK have automatic wheel washes, an all-over truck wash was in operation on the majority of farms in Brazil. *(See picture on next page).*

There were varying degrees of strictness with regards to going onto poultry farms as a visitor. Some of the companies visited, mainly in Brazil, did not allow visitors on the farms at all, although this was not the case with all companies. The procedures that had to be followed when going on to poultry farms were hugely variable around the world, and differed from company to company. All farms visited provided boot covers to be put on before entering the site, in one case, double boot covers were applied. In some cases foot dips were provided on entering each house, in others boots were changed before entering the house, in others there was no change to boots, covers or dipping between houses. On one farm in Holland, before entering the site, overalls, boot covers, caps and rubber gloves were provided and then different boots were used before entering each of the houses.



One area that seemed to be in the process of changing was the protocol of showering before entering a broiler farm. This was seen on very few farms during the study tour but a number of farms and companies suggested that this was one of the practices they were looking to implement in the future.

One of the luxuries afforded by Brazilian poultry farms is space, which enables them to have higher levels of biosecurity by isolating farms. Farms are often isolated with fencing and where possible trees are also used to isolate.

One of the main points taken from the study tour was that on farms that were producing ABF birds the protocols were not as strict as expected. This is not to say that biosecurity is not an important area to consider when reducing or removing AB, however it seemed that standards were not any higher when compared to those on farms that were not looking at AB reduction.



Figure 7. Image showing the all-over truck washes that were commonplace on most Brazilian farms



## 6.4. Housing/equipment

During the visits to the Netherlands there were several companies that were placing a lot of focus on the importance of a good start to a chick's life and its requirement for feed and water. A lot of work has been carried out into the utilisation of hatching systems and equipment to enable a chick to have immediate access to feed and water as soon as it requires post hatching. Three prominent systems were demonstrated during the study tour. One was the HatchCare system produced by HatchTech and the other two were both systems from Vencomatic. Other than the systems seen in Holland, the only other reference to early access to feed and water was a Brazilian company that put slices of orange, with feed on top, in the trays for chicks which were undertaking very long journeys.

### 6.4.1. Hatchcare

This system is marketed as the “Hatcher with feed and water” and purports to provide higher hatchability as well as stronger and healthier day old chicks. In a normal hatching system the chicks will hatch within a ‘hatch window’ and it is generally accepted that all chicks will remain within the hatcher until the hatching time window is up. During this period the chicks will have no access to feed and water.

In the Hatchcare system the chicks will hatch into specially designed ‘Care baskets’ which they will drop down into from the ‘Care tray’ above. The ‘Care basket’ is designed in such a way that the birds have access to feed on two sides in the feed troughs, and to water via the drinking gutters on the other two sides.



Figure 7. Picture showing the Hatchcare tray and hatcher setup with the eggs placed in the top basket, and the “Care tray” below with the feed and water for the newly hatched chicks.



The theory behind this system is that in a conventional hatcher it can be between 24 to 36 hours between the first and the last chick hatching. By the time the chick is processed and arrives on farm it can have been without feed and water for between 60-80 hours. This is not thought to be a problem as the chick has a residual yolk sac which it can utilise to survive during this period. However, research has shown that when the chick starts eating very soon after hatching the feed that is digested pushes the residual yolk into the intestinal tract stimulating nutrient absorption from the yolk. This means that the feed available within the hatcher can provide the chick with the energy it requires for basic maintenance and the yolk can be used for immune system development.

As well as providing early access to feed and water the Hatchcare system has MicroClimer technology, patented by HatchTech. The hatching unit is divided into 12 sections, each of which are individually controlled for temperature and automatically adjusted to ensure the correct temperature for each embryo and chick. The radiators are specially designed to ensure that the air flow is distributed in parallel layers and keeps the air speed uniform around the eggs.

#### 6.4.2. Patio

The Patio system is a multi-tiered unit for raising broilers that was developed by the Vencomatic group in the early 2000s and is designed to hatch and house broilers on the farm as opposed to receiving day old chicks. Eighteen-days incubated eggs are inserted into the system on setter trays, and when the chick hatches it has immediate access to feed and water. The system is set up in insulated compartments with two system rows for each compartment, with each row being made up of six levels on top of each other. The bottom of each level where the chicks are housed is a moveable belt which allows a high level of automation and limited handling of the birds, hence giving a high level of biosecurity.

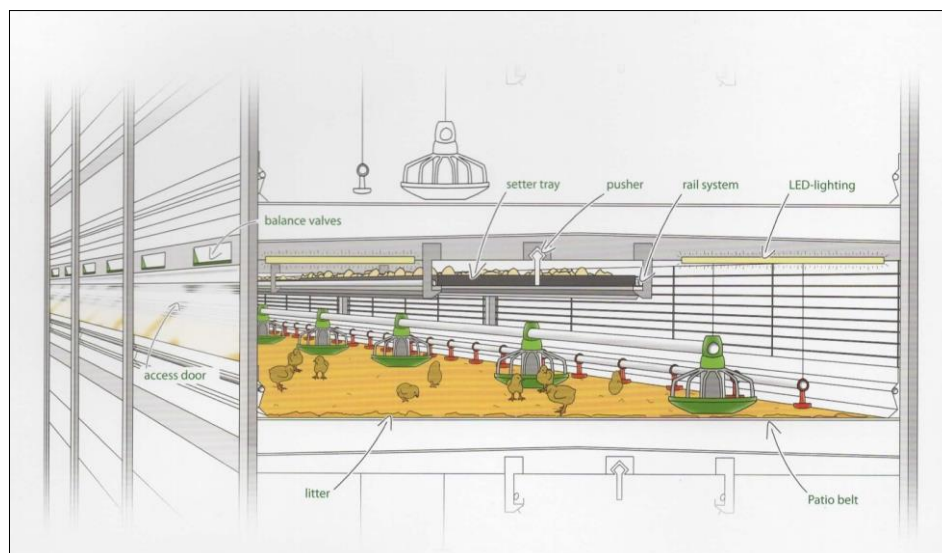


Figure 8. Diagram illustrating the set-up of one of the tiers of the Patio system. Source: Vencomatic Group



The hatching environment provided by the Patio system is quite different to that of a conventional hatcher in that the air volume is much larger and seems to have a lower optimum hatching temperature and humidity. The rows are separated by a middle corridor and two corridors at each side. This allows fresh air to be delivered to the outer corridors which moves through the system due to the pressure created by the fans in the central corridor.

The system cannot be put into existing houses; the whole building has to be built as a new unit. At the time of visiting units were in place in Russia and the Netherlands. The maximum length is 160m and stocks at 2.8 birds per square meter of concrete.

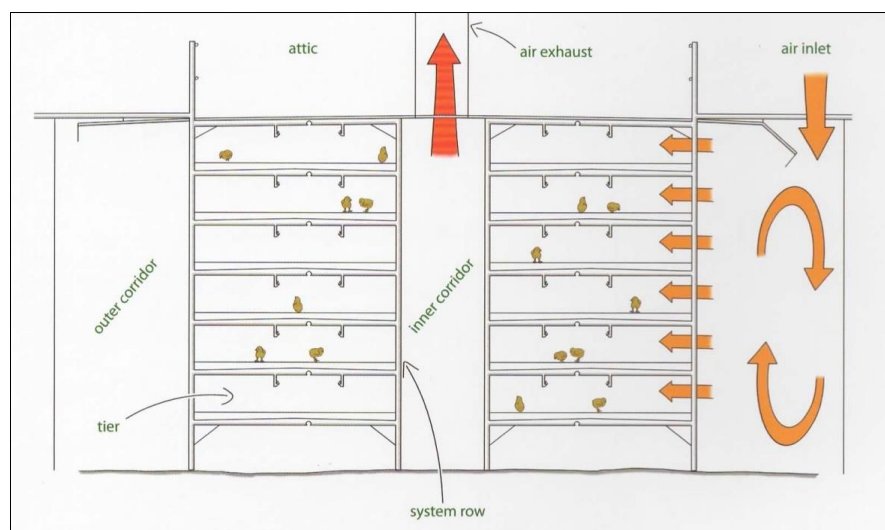


Figure 9. Diagram illustrating the set-up of the Patio system and the air flow.  
Source: Vencomatic Group

A visit was made to the test system although no pictures were allowed to be taken. Pieter de Giouw of Vencomatic provided information on the trials and results that have been run with the Patio system. The test farm has been running since 2008 and at the time of visiting they had run 66 cycles with an average mortality of 1.1%, and 1.5% hatchability. The most significant result is that in 7 years they have not used any AB in the test farm and in 10 comparison trials the control flocks have either used AB or had higher mortality.

### 6.4.3. X-Treck

The X-treck is another system developed by Vencomatic to try to reduce the use of AB by giving hatched chicks immediate access to feed and water. As with the Patio system, rather than a broiler farmer receiving day old chicks they receive 18-day incubated eggs and the last three days of the hatching process is completed within the broiler house itself. The system consists of a metal framework that is suspended from the ceiling of the poultry house which can be winched down for hatching and then moved out of the way once all of the chicks are hatched.



Mr Kees Koolen is a Dutch poultry farmer who has been trialling the X-treck system in conjunction with Vencomatic. At the time of visiting he was on his 8<sup>th</sup> flock with the X-treck system being trialled in one house and being compared to a control house receiving day old chicks. Before the eggs arrive, Mr Koolen heats the house to 36° Celsius to try to keep the eggs at the desired temperature of 36-37°. His staff monitor the temperature of the eggs with a human ear thermometer and have found that if the temperature rises to over 38° Celsius the eggs hatch too early. They have to regularly monitor the temperature to ensure it is kept within the optimum range which can be quite time consuming and this is something that Mr Koolen would like to be automated. The 'hatch window' on the farm is generally the same as in the hatchery, so 24 hours before the day old chicks arrive for the other house, 90% of the eggs in the broiler house will have hatched. Mr Koolen believes the in-house hatching to be better for the chicks as the environment is more sterile and there is less stress placed on the chicks as they are not waiting in the hatcher for long periods of time. In general Mr Koolen believes that the early feeding aids the intestinal development which in turn enables the bird to deal with bacterial challenges, coccidiosis challenges and leg problems caused by enterococci cecorum, which he says are reduced by over 90% with this system. He feels that the chicks hatched using the X-Treck system are achieving 50-60g more in weight and an FCR approximately 3 points better and that it also helps to reduce his AB use. Mr Koolen also commented that although the chicks go for feed reasonably quickly, usually within 12 hours of hatching, they do not seem to go for water as quickly.



Figure 10. Picture taken at Mr Koolen's farm in Holland demonstrating the Vencomatic X-Treck system.

A separate visit was made to another innovative Dutch poultry farmer who had constructed his own hatching framework and was trialling the concept of hatching eggs in the broiler shed itself. At the



time of visiting the use of the system was in its infancy (2<sup>nd</sup> cycle) but he was happy with the way both system and concept had worked so far and was going to continue purchasing 18-day incubated eggs. One of the downsides to his system was the increase in labour which came from having to monitor the temperature of the eggs and having to clean out the shells and trays.

This farm had had a similar experience to Mr Koolen in that the eggs were almost 90% hatched before the day old chicks arrive for the other houses. They both also felt that although the chicks go for feed reasonably quickly, usually within 12 hours of hatching, they do not seem to go for water until approximately 24 hours. The ability to control temperature is key for this system to work and the second Dutch farmer felt that he was only able to try using this type of system because of his underfloor heating. The floor is maintained at a temperature of between 34-35° Celsius and he monitors the egg temperatures with a human ear thermometer.

## 6.5. Farm management

The way in which a farm is managed can also play a role in its ability to reduce its AB usage with the key areas being stocking densities, turnaround times, litter management and the farm manager.

### 6.5.1. Turnaround times and litter management

In terms of its effect on bird performance and AB usage, the importance of turnaround time is often overlooked. In Brazil most companies would ideally like to have a turnaround time between cycles of 14-15 days. However, the number of companies visited that was actually achieving this was relatively small. A Brazilian breeder company that was visited shared that by increasing their turnaround time they decreased their spend on AB by over 90%.

The main reason that turnaround time is of importance, predominantly in the US and Brazil, is for litter management. In both these countries the approach to litter is different to that of the EU in that it is reused, usually for up to 6 cycles or a year. If the house or farm encounters disease issues then this litter may be changed earlier. In the US, companies growing ABF poultry all cite litter management as one of the key areas. The management of the litter is closely linked to turnaround time, and it is for this reason that the turnaround times in the US and Brazil aim to be 14-15 days. This gives them time to work the litter as much as they require.

One US company aims to pile the litter up, leave it to ferment for 3 days, rotate it and pile it up again, then ferment for another three days, so that ideally it is rotated three times. It is then put back down again and left to cool for 4 days. For this they require downtime of 18 days. This process tries to ensure that any bacteria within the litter are unable to survive due to the temperature of the litter as it ferments. A number of people suggested that the first crop on new litter is always the most difficult. This may be because the litter is less absorbent or it may be due to a lack of house microflora in new litter (discussed in detail further down).

The importance of litter management is not particularly relevant for UK poultry producers as the reuse of litter is not a practice seen in this country. However, the importance of the correct



turnaround time is relevant in ensuring that all work that needs to be carried out in this period can be done so correctly.

### 6.5.2. Stocking density

Opinions on whether a reduced stocking density is required to enable AB to be removed from production programmes were varied. An American company was trialling the effects of stocking density at the time of visiting although their general consensus was that it didn't seem to make a huge difference. They did not initially reduce stocking densities when converting to ABF although they are currently running trials to assess the effects of a reduced density. However, another American company does produce ABF broilers at a lower stocking density than conventionally produced birds.

In Brazil one of the most frequent changes made on farms that were looking to alter their growing programmes to export to Europe was a reduction in stocking density. For example one company had a stocking density of 11.5 birds per square meter on farms producing birds for export to Europe, compared to 13.5 birds per square meter on farms producing birds for the domestic market. A different company had a reduction from 14 birds per square meter to 11 birds per square meter for European export.

### 6.5.3. The role of the farm manager

The importance of the farm manager in the ability to raise poultry without AB provided many interesting discussions during the study tour. Most of the larger companies in the US that have a vast number of farm managers producing poultry for them agreed that there are some farm managers who are more successful at producing birds without AB. In the US many poultry farm managers will also have second jobs away from the farm and their ability to successfully produce ABF poultry is often correlated to how much time the farm manager spends with the birds.

Another factor to consider alongside the skills of the farm manager is their attitude towards using AB. Historically AB have been used not only for treatment but also as a prevention or prophylactically. When it comes to removing or reducing AB in a poultry production programme some farm managers find the change difficult and the solution is often about changing their attitudes as to how AB should be used. Often when growers are asked to change their practices they have to have it demonstrated to them that it is possible, and that the methods and practices being suggested do work.

## 6.6. Strategic approach

One of the simplest ways described on how to go about reducing AB or going ABF was to approach it like a Hazard Analysis and Critical Control Points (HACCP) assessment. Each farm needs to be looked at individually and assessed for its risk points and where the farm normally encounters problems. Once these points have been established then a protocol and practices need to be put in place to try to prevent those risks becoming hazards.



### 6.6.1. Seed, feed and weed

During a visit to the University of Georgia's Poultry Research Centre some time was spent with Professor Steve Collett. Professor Collett is a Clinical Associate Professor whose particular interest lies in the management of the bird's digestive tract to maximise bird welfare, nutrient uptake and performance. Professor Collett has consulted in over 20 countries and has been involved in numerous programmes to reduce AB around the world.

The programme which Professor Collett uses is commonly known as Seed, Feed and Weed and its aim is to control and utilise the bird's own microflora in the gut to overcome challenges that would normally be treated with AB.

The first stage is the seeding of the gut. The current programme in the UK for producing chicks has taken away the opportunity for the chick to receive its gut flora from its parent. In the wild a chick would hatch in a nest environment where it would be exposed to its parent's faecal material. When hatching chicks commercially the environment is sterile and therefore the only microflora the chick has is what it can pick up from the hatchery environment. In the UK the situation is exacerbated by placing chicks on fresh litter in a presumably sterile house environment. In the US chicks are, for the main part, placed on reused litter which will contain a microflora environment from which the chick can obtain bacteria for its own gut microflora. In the UK because we have fresh litter there is no opportunity for the chick to develop its microflora. Therefore, the 'Seed' stage is an intervention to help populate the chick's gut with the correct microflora. This can be achieved using probiotics or competitive exclusion products. In the US competitive exclusion products are not allowed, so they use direct fed microbials, probiotics or defined cultures with the aim being to use a primary species that colonises the host. Professor Collett advises that the earlier you can populate the chick's gut the better and this process should preferably be carried out in the hatchery. By the time the chick reaches the broiler farm it is often too late and the microflora from the breeder and hatchery has already proliferated.

The next two stages of the programme are aimed at helping the good desirable bacteria in the gut of the bird to thrive. By enabling the bird's own microflora to flourish you decrease the opportunity for negative pathogens to thrive, primarily by competitive exclusion.

The 'Feed' stage involves the utilisation of organic acids. These can be administered via the water or the feed and help to alter the gut environment. Primarily the organic acid arrives in the small intestine and enables the acid-loving organisms to proliferate by providing them with a nutrient source. By enabling them to proliferate, the alkaline-loving bacteria are prevented from thriving by two methods. The first is that the alkaline bacteria have to compete with the thriving population of the gut bacteria for nutrients and, secondly, the environment is inhospitable due to its acidic nature, which is maintained partly by acids that are secreted by the microflora.

The 'Weed' stage is another way to suppress the competition to the bird's microflora from pathogens by using type-1 fimbriae blockers. These act to prevent any negative pathogens that may have entered the gut from taking hold. When organisms colonise the gut they attach to glycoproteins on the cell membrane of the gut cells. The type-1 fimbriae blockers (usually administered via the feed) actually mimic the docking site that the organism would try to adhere to



and, by attaching to the pathogen, they prevent it binding to the gut wall and force it to pass through the gut without adhering.

By carrying out all three stages of this programme the gut environment of the bird should be at its optimum enabling the bird to fight any challenges it may receive.



## 7.0. Drivers for change

There are two main reasons why a poultry farm or company may look to reduce or remove AB from its growing programme. The first is for legislative reasons, the second is for market reasons. It became very obvious during this study tour that the countries visited differed in their reasons for altering their usages of AB.

### 7.1 Legislative strategy for reducing antibiotics

The Dutch poultry industry is a prime example as to how legislation can be used to reduce AB usage and the process is detailed below. The US is also starting to look at changing its legislation to decrease the development of ABR.

#### 7.1.1. The Netherlands

The way in which the Dutch approached the overuse of AB in agriculture was an interesting and seemingly successful method. In 2007 discussions started at government level with regard to the use of AB in livestock production sectors, with an agreement being made that each sector was to take the initiative in its approach to reducing its use of AB. The government would monitor the results and intervene if it felt necessary. In other words the livestock sector was advised that it needed to take action or the government would have to get involved to force change and, in 2008, an official voluntary agreement was announced. The agreement covered all animal production sectors with the reduction targets the same. The benchmark year was 2009 where accurate levels of usage were recorded from which reduction levels were set as follows:

2011 – 20%

2013 – 50%

2015 – 70%

The action plan that was put in place involved several steps which covered all sectors although some sectors had their own specific actions.

#### Step 1

Registration of all AB used in a central database must be carried out by the veterinarian including the type of AB, the quantity and dosage, and length of treatment. The vet must also register any clinical signs and diagnoses which within in the poultry sector were standardised. This was to ensure that the actions put in place were producing the desired results and to enable individual benchmarking for each farm.



## Step 2

Each farm must have a contract with a vet and it must only use that specific vet. Farms cannot use multiple vets and must form a working relationship with one vet only. This ensures that the veterinarian is familiar with the farm, its history and its production system. Only the vet that is contracted to that farm is able to prescribe AB and this can only be done after diagnosis is made upon visiting the farm.

## Step 3

The vet and farmer must work together to come up with health and treatment plans, preferably along with other farm advisors. The health plan analyses the farm's management in terms of animal health, climate, feed, water system, welfare and the use of AB. From the health plan the vet and the farmer must come up with improvement measures that the farmer then has to implement. The treatment plan is drawn up mainly by the vet with some cooperation from the farmer. The plan details how diseases will be tackled in the next period, how diagnoses will be made and the utilisation of bacteriological and sensitivity tests. These plans must be evaluated at least once a year.

## Step 4

The action plan involved the veterinarians as well as the farmers and made use of specific formulae for prescribing AB. This included lists of relevant indications for each animal and which AB (first, second or third choice) can be used for each indication. AB are categorised based on their effectiveness, the risk of resistance developing or spreading, and whether they are critical for human medicine. Those that are categorised as third choice must be given at the right dosage to avoid low level usage which increases the risk of resistance developing.

## Step 5

Each farm receives an individual benchmarking report (*see graphic on next page*) which details their AB usage in the last period (usually 3 months) to increase the farmer's awareness of their AB usage and how they can improve. The report not only details the individual farm's usage but compares it to the national average. The benchmarking report is fairly comprehensive with graphs indicating the overall use of AB per production cycle, the weeks during the cycle in which treatment was started, the reason that AB were used, and which class of AB were used. In the poultry sector the veterinary practices also receive a benchmarking report which details their prescription of AB across all their clients.

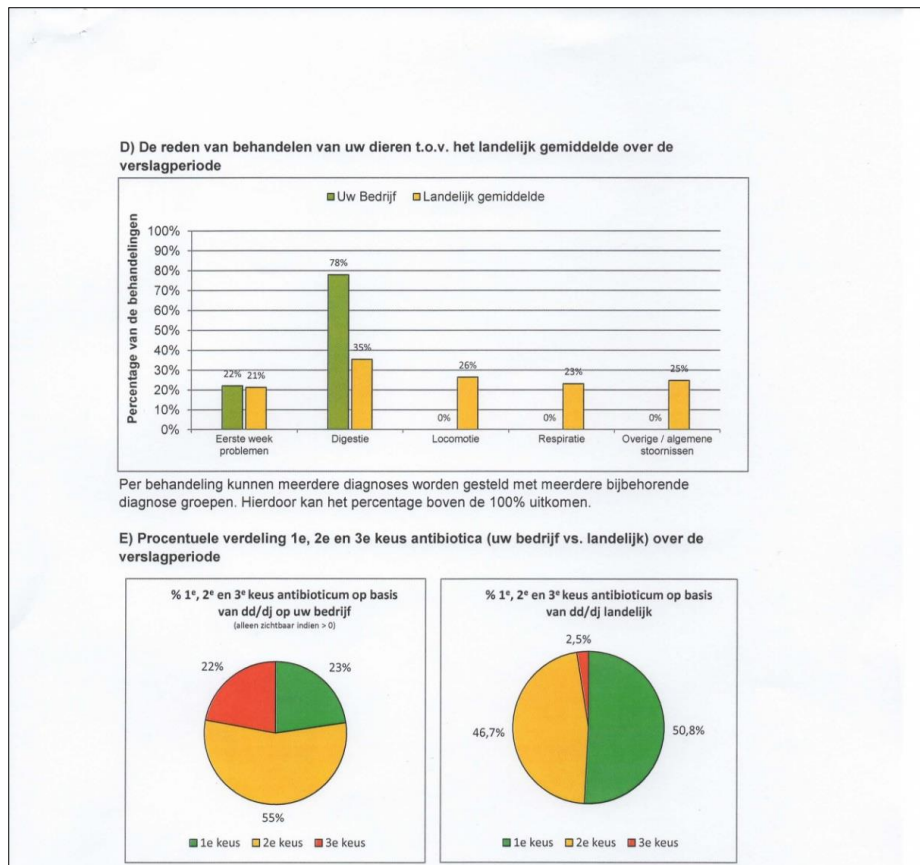


Figure 11. Image showing an example of the benchmarking report that farms receive.

These graphs show the farmer how his usage compares to the national average.

The top graph is the reasons that he used AB (ie respiratory, first week issues, leg issues etc).

The bottom two graphs compare the class of AB that he used, together with the national average.

The green sector is 1<sup>st</sup> class AB, the yellow 2<sup>nd</sup> class, and the red 3<sup>rd</sup> class. Source: former Dutch Product Board.

## Step 6

The benchmarking report enables an approach for each individual farm to be formulated to continue the reduction of AB. Each farm will be assessed and categorized every 6 months and there are four categories that a farm can be in. The target category is where farms that are performing satisfactorily with regard to their AB usage are placed. The next categories are the signal category, action category 1 and action category 2. The aim is that each farm should move up to the next category within 12 months. There are measures that have to be taken by each farm, the strength of which is determined by the category. Farms in the signal category have to produce a plan for improvement within 4 weeks of the categorisation. Farms in the action category 1 will be subjected to extra mandatory screening and those in action category 2 will have to use an independent expert at their own expense.



## Step 7

This step places an extra focus on the reduction of AB that are critically important for human medicine as identified by the Dutch Health Council. Any AB that were classified as critical to human medicine were deemed to be third choice AB for veterinary use and this mainly covered fluoroquinolones and 3<sup>rd</sup> and 4<sup>th</sup> generation cephalosporins. Specific to the poultry industry is that any farms that use these AB have to put an extra improvement plan in place to try to prevent any future use.

The Dutch poultry industry commenced its reduction programme in 2009 with a target of 20% reduction in AB used by 2011. The total reduction was actually 32% for this period.

By 2013 they were hoping for a reduction of 50% with an actual reduction of 58% achieved by the first 6 months of 2013.

The target for 2015 is 70% and at the time of visiting they were unclear whether this target would be met.

### 7.1.2. The USA

Although the American poultry industry has a number of producers who are raising birds without AB the current situation with regard to legislation is quite different from that of the EU. As it stands currently, US poultry producers are able to feed low level AB as growth promoters in the poultry feed.

However in 2013 the Food and Drug Administration (FDA) released Guidance Document 209 which sets out principles for “The judicious use of medically important antimicrobial drugs in food producing animals”.

The two main principles are:

1. The use of medically important antimicrobial drugs in food-producing animals should be limited to those uses that are considered necessary for assuring animal health.
2. The use of medically important antimicrobial drugs in food-producing animals should be limited to those uses that include veterinary oversight or consultation.

What this means is that the FDA believes that the use of medically important antimicrobials for the promotion of growth is not judicious use, and is recommending that this practice should be avoided. Antimicrobials that are medically important should still be used for treatment, control and prevention of disease but not for enhancing the production of animal derived products. Currently antimicrobial drugs used in the feed for treatment, control and prevention of disease, as well as growth promotion, are available over the counter. However the FDA is trying to phase in, with this guidance document, the voluntary practice of veterinary oversight or consultation in the use of medically important drugs.



The relevance of this is that it is only a guidance document so although it sets out the principles they are not currently enforced. However, guidance documents are often an indication of how things are going to be in the future so although this is currently not an enforced law it is widely expected that it will become one. Although these changes are nowhere near what the EU has in terms of restrictions the interesting point is that they are being introduced gradually. So although legislation is being used to drive change it is being done as guidance initially rather than enforced. This gives US livestock producers time to accept and adapt gradually, which they believe is the right way to go about making changes and reduces the risk to animal welfare.

## 7.2. Market drive for reducing antibiotics

The Dutch poultry industry was effectively forced to alter its use of AB by its government. However, in both America and Brazil poultry companies were making the decision for themselves to remove or reduce AB as it gave them a competitive edge over other companies. In America some poultry meat was being marketed as never having had AB during its life and producers were gaining a premium price for this product. In Brazil, companies were taking the option to export meat to Europe for which they needed to remove AB growth promoters from the feed. They were also gaining a premium price for this over meat that was produced for the domestic market.



Figure 12. Photograph detailing the meat available to US consumers.  
The price of an ABF whole chicken was \$2.69 compared to \$1.29 for a standard bird.



The other topic that was heavily discussed whilst in America was whether ABF poultry meat will actually become a commodity. Currently poultry producers in the US are able to charge a premium for their product but there is a lot of talk as to whether this will still be the situation in the months and years ahead.

In January 2015, during the week of the IPPE in Atlanta, DuPont and Watt Media sponsored a round table discussion entitled “Antibiotic-free broiler production isn’t a niche market”. The panel was made up of Dr Bruce Stewart-Brown of Perdue Farms, Dr Steve Collett, clinical associate professor at the University of Georgia, Dr Gregory Siragusa, microbiologist at DuPont and Richard Kottmeyer of Strategic consulting firm. Although both Dr Collett and Dr Stewart-Brown discussed their experiences of producing ABF poultry the interesting point with regard to the market place was whether the tipping point had been reached on ABF poultry being a niche market.

In 2014 Chick-fil-A announced that it was going to work closely with its suppliers to remove AB from their production over the next five years and serve only ABF poultry meat in all its restaurants. The reasoning behind this was two-fold in that AB usage in poultry production was high on the list of things consumers polled said they were concerned about, but Chick-fil-A also wanted to increase their market share in different areas of the US and saw ABF chicken as one way of doing this. In early 2015 McDonalds followed Chick-fil-A by putting out a statement that within two years they would only serve chicken that was free from AB that were critically important to human medicine.

The implication of these announcements and changes for the US market is that ABF poultry meat is seemingly going to become commonplace. The issue is whether this is sustainable if producers are no longer able to charge a premium for this product. If it is no longer cost efficient then US producers may cease to grow ABF poultry meat.



## 8.0. Implications of reducing/removing antibiotics

When embarking on a programme to either reduce or remove AB from a poultry production unit there are two key things to consider, the effects on cost and performance and bird welfare.

### 8.1. Cost and performance

Speaking to people and companies around the world gives a very mixed view as to whether reducing or removing AB makes it more expensive to produce poultry or not. The general thinking is that if the AB are replaced with alternatives of a similar cost to get through the risk periods, and the farm management is of a good standard, then the cost should be negligible.

Other companies, particularly in the US where they are growing birds ABF, the view is that there is a cost implication to the programme. Part of the increased cost comes from the fact that the birds tend to grow a little slower in an ABF programme; you can get a comparable performance but there is a slight cost implication as it takes longer to reach that target.

The general consensus is that birds can be produced without AB and still hit the same performance parameters as birds that have been exposed to AB but, in order for this to happen, all of the areas discussed previously have to be right and working to the best of their capability.

### 8.2. Welfare

The other concern is that of bird welfare, which in some ways is linked back to cost. If a producer is growing birds for an ABF market (the US) or for export (Brazil) then they have to meet targets for AB used. If part of the flock gets sick and requires treatment there is a knock-on effect that occurs if that treatment is carried out. If the birds are treated then they can no longer be sold as ABF and therefore the company has to find somewhere else to send them. This provides an economic incentive not to use AB. This can, however, lead to an animal welfare issue with sick birds not being treated for economic reasons.

A number of Dutch farmers were asked what their views were when the announcements were made in 2008 about the plans for AB reductions. One of the questions asked was whether they were concerned for their birds' welfare with the imposed changes. Most of the farmers said that they had been prepared for the changes to come in and were ready for them when they did, hence they were not worried about bird welfare.

From the study tour it would seem that the only welfare issue that comes from reducing or removing AB is when that change is driven by consumer demand.



## 9.0. Discussion

This report has looked at the drivers for a change in AB usage and how broiler farmers can utilise products and practices to enable them to make these changes. When looking at the changes farmers and producers need to make it is also important to consider the attitudes they have towards the use of AB. They need to understand or have a level of awareness as to the reasons why they are changing the way they use AB.

When looking at alternatives to AB there was quite an interesting contrast between the attitudes of industry people towards alternatives and the range and frequency that alternatives were actually used. When asked about alternatives to AB a number of those interviewed suggested that they didn't view these products as particularly helpful or important when it came to the key factors in aiding the reduction of AB. A large number of people believed that the farm manager and biosecurity were more important. However, every farm and company visited was using at least one alternative to AB if not more. Whether this is because the producer felt that by using an alternative they were at least trying to do something, more for their own peace of mind rather than the product having the desired effect or not, is difficult to say. It is fairly clear from the amount and range of alternatives to AB used around the world that these products most definitely have a place on the farm. With regard to whether they achieve what they set out to is a different matter. It is most likely to be the case that each farm will need to try a range of products from the different categories to find which provides benefits to them and which don't. Products that produce the desired result on some farms may not have the same effect on other farms.

This report has discussed a number of Dutch systems that looked at the early access to feed and water for chicks. Each of the systems has drawbacks that may make them undesirable for the UK market. The X-treck system requires hatcheries to sell 18-day incubated eggs to the broiler farmer. This will involve a change in the way the poultry production chain functions and because of this it may face opposition. Although Vencomatic suggest that in Holland the hatcheries are happy to do this because it takes one of the risk periods away from them, it is difficult to say how UK hatcheries may feel about this. The Patio system's main opposition comes from the way that it looks and the way it will be perceived by the UK consumers and opposition groups. As mentioned earlier, pictures of the system were not allowed to be taken and, even though the performance results from this system suggest that it works very well for improving bird health, it may be difficult to convince people. Another factor to consider is the increased floor space that a tiered system allows. In a world where we will be expected to feed 9 billion people by 2050, systems that enable healthy but efficient production should be considered irrespective of how they may be perceived by the public.

Water quality and sanitation is another key area that poultry producers need to consider. There is a definitive move towards continual sanitation programmes and more regular monitoring of water quality. This includes both analysis of the incoming supply and testing of the water available to the birds.

Whilst biosecurity is often thought of as highly important when it comes to disease control, this does not seem to translate when it comes to enabling farms to reduce or remove AB. Farms that were producing birds without AB or that were trying to reduce the level of AB used did not seem to have any higher standards for biosecurity than those that were not. That is not to say that biosecurity



does not need to be of a good standard to enable AB reduction, but it does seem to be that the level of biosecurity does not need to be raised above what is expected as standard in the industry.

Stocking density was an interesting area of discussion throughout the study tour with mixed opinions as to whether a reduced stocking density was required for removal or reduction of AB. One way of summarising the role of stocking density in AB reduction is that it does not necessarily need to be reduced in order for a reduction to be achieved, however reducing stocking density should make it easier to reduce AB usage. The other area to consider with reduced stocking density is the cost implication. If a slightly longer production cycle is required to enable ABF production then this brings with it a potentially increased cost. To then reduce the stocking density as well would increase the production cost further. Therefore, if producing birds with little or no AB is to be financially viable then it probably needs to be achieved without reducing stocking density if a longer growth period is required.

The role of legislative changes in reducing AB is an interesting one. It is commonly remarked upon that when the Danish agricultural sector decided to remove low level AB from the feed, they did so almost overnight, and as a result saw a dramatic increase in the therapeutic use of AB to compensate. Both the Netherlands and the US went about/are going about things over a longer period of time to give their producers time to adapt, which seems to be a more successful way of bringing in legislative changes.

One of the key parts of the Dutch reduction programme is the monitoring of usage and the benchmarking reports. The information provided in these benchmarking reports is important in helping farmers understand how much AB they are using, when they are using them, and why they are using them. This report would be very useful in helping farmers to identify the risk areas that were discussed under the strategic approach to reducing AB. Understanding how often a farm is using AB and why they are using them is key to enabling procedures to be put into place at the right times. This is one of the things that the US poultry industry has little to no data on, which is one of the reasons they are under pressure. Because the US has no usage data the only figures they have for AB used in agriculture are sales data – which indicates that 80% of all AB sold in the US are used in agriculture. They are currently looking into ways to monitor usage to enable them to try to refute the sales data claims.

One of the dangers of the constant monitoring programme is the risk of driving AB usage underground. It is thought that the constant demands on Dutch poultry farmers to reduce AB usage may have driven some farmers to try to obtain AB illegally. Although this is unsubstantiated it is something that should always be considered when closely monitoring and forcing change.

Another factor to consider when monitoring usage and comparing data, is the figure which is used to measure usage. 2 Sisters Food group are using the defined daily dosage and the mg/kg of live bodyweight yet in Holland a variety of different measures are used. It is important to take into account which calculation has been used in determining the AB usage data to enable a fair comparison to be made.

In the US one of the topics of the moment, as discussed, is whether ABF poultry meat is no longer a niche market. How this relates to the UK industry is quite interesting. When discussing with UK retailers it seemed that there was little to no market for ABF poultry meat. However, with the



announcement from McDonalds - that extends in some part to the UK - there is now a market driver for reducing AB. It would seem, however, that the UK may not have the opportunity to gain a premium for poultry meat produced without AB and that a reduction may become expected as standard across producers.

In the UK, poultry producers need to understand that they have a choice as to how they interpret the changes to the way AB are used. As a general rule the changes can either be seen as an opportunity or a threat. In very simple terms if legislation is the driver for the change then it is often seen as a threat and a change that is being forced; if the driver is the marketplace and obtaining a premium for the product then it can be described as an opportunity. However, many of the Dutch farmers visited say they were prepared for the changes that were being brought about and had already started looking at ways to enable them to adapt before the changes were in place. From this it could be said that they took the changes as an opportunity to assess the way they were producing poultry and determine the areas in which they could improve. This is something that UK farmers would benefit from doing also; taking any proposed changes as an opportunity for improvement to their production systems.

If a producer decides to look at reducing their AB usage then they need to approach the changes like a HACCP. The farm needs to be assessed for its critical points to determine when it is normally using AB. From this the producer can then look at the options available to him to try to prevent the potential risk becoming a problem. The other important thing to consider is that each farm's critical points will be different. Therefore a programme that is put in place on one farm will not necessarily work on another. All programmes put in place to remove or reduce AB need to be individually tailored to that farm, taking into account their individual problem areas.

As discussed, the two main considerations to take into account when reducing or removing AB from a poultry production programme are the cost and performance implications and the welfare of the bird. It is inevitable that any changes made to production programmes to reduce AB may initially have negative effects on the farm's performance with potentially increased costs. Farmers should persevere, though, as it is possible to produce birds with little or no AB with a limited effect on cost or performance, but it may take time to achieve this. The other concern is welfare and this is something that has to be taken into consideration when looking at legislative changes. Completely banning AB is not a viable option for any livestock sector. AB should always be available to prevent the spread of disease and infection and to ensure that birds that require treatment are able to be treated.

From this point it is possible to address the initial question: is 'No antibiotics ever' an option for the UK poultry industry? As can be seen from this report it is possible to raise poultry without AB and therefore it is one option available to poultry farmers. However, it should not be the only option available. As discussed, there is always the risk of the spread of disease and infection and AB should be available to prevent this happening. Bird welfare is also an important consideration and birds should not be allowed to get sick and die when an option is available to prevent this. The way in which AB are used needs to be assessed to ensure that they are only being used when it is truly necessary but they must be available for when that time comes.



## 10.0. Conclusions and Recommendations

### 10.1. Conclusions

#### 1. Alternatives to antibiotics

The use of alternatives to antibiotics should not be overlooked but must be approached with caution. Farmers need to be prepared to try a number of different alternatives to find the ones that work on their farm and to be open to experimenting with these products to find the ways in which they work best for them.

#### 2. Water sanitation.

The role and importance of water has established itself as one of the key areas for poultry producers to look at, with a definitive move towards continual sanitation throughout the flock cycle in addition to existing terminal hygiene programmes.

#### 3. Strategic approach

When assessing a farm in order to reduce or remove antibiotics from the production programme it needs to be approached like a risk assessment, identify the problem areas and then decide on the solution to prevent the risk becoming a problem.

#### 4. Individual farm programmes

Each farm will have different requirements to enable it to remove or reduce its AB usage, therefore the programme put in place for this to happen needs to be tailored to and individual to that farm.

#### 5. Opportunity or threat?

UK poultry farmers need to see any legislative changes or producer requirements for a reduction in antibiotics as an opportunity to assess their production practices and look for areas to improve.

### 10.2. Recommendations

1. If government bodies or other groups are looking at bringing in legislative changes to reduce or remove antibiotics from UK poultry production it is important that these changes are brought in slowly so that the industry is given time to adapt and find alternative ways to enable production with fewer or no antibiotics.
2. UK poultry production companies need to be aware that individual farms may require a different approach to enable them to reduce the use of antibiotics in their production programmes. It is unlikely that one programme will work across all their growers.
3. The welfare of the bird is the most important thing to consider when looking at reduction or removal of antibiotics. Whatever the driver for change is, it is critical that the changes are not brought about at the expense of the bird's welfare. Antibiotics should still be used when necessary for both the bird's health and the control of disease.



## 11.0. After my Study Tour

The Nuffield Farming Scholarship programme has resulted in a number of changes both to me personally and to my career.

The knowledge, understanding and contacts that I have made as a result of this experience has enabled me to develop my role within the business. We have decided to broaden the range of products and services that we offer to include products that act as alternatives to antibiotics and that run alongside our water sanitation system. We are also working with other companies within the industry to promote the control of poultry bacteria as an integrated solution to removing the reliance on antibiotics in the UK poultry industry. This involves individual assessment of farms to come up with a programme of products and solutions to assist in bacterial control on that farm. We are also looking to expand our systems and programmes to cover the pig industry in addition to poultry.

I am hoping that in the future I will continue to learn more about the role of antibiotics in UK poultry farming and how we can move forward without a reliance on these products. I hope that the skills and knowledge that I have gained will enable me to act as an advisor to any UK poultry producers or farmers that are looking to change the way they produce broilers with less reliance on antibiotics. In the future I would like to be someone that poultry producers could go to for advice on how to make changes that would allow for improvements to be made on their farm.

Part of the reason that I now feel confident enough to pursue the above mentioned career options is due to personal changes that undertaking the Nuffield Farming Scholarship has had on me. Simple skills like networking and engaging with other industry professionals on both a business and personal level are skills that have grown and developed throughout the duration of my scholarship. Undertaking the scholarship has also helped improve my confidence and self belief which is aiding me hugely in developing my career.

I would like to think that the findings of my study tour presented in this report may pique the interest of certain groups in the industry and that my findings are something that people may want to hear more about.



**Sophie Edenborough**



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