# ANTIBIOTIC USE IN ORGANIC FARMING

## LOWERING USE THROUGH GOOD HUSBANDRY

ALLIANCE TO SAVE OUR ANTIBIOTICS | APRIL 2021

# CONTENTS

# SUMMARY


Antibiotic use is permitted in British and European organic livestock farming. However, in contrast to the rules for most other forms of farming, organic standards have never permitted routine antibiotic use or the use of antibiotics for preventative mass medication. Furthermore, organic farms are required to meet high animal health and welfare standards.

For these reasons it can be expected that organic farms will use far fewer antibiotics than in intensive systems, even though there has been a very welcome 48% reduction in veterinary antibiotic use in the UK since 2014 following a number of voluntary actions taken by farmers. However, for many years data on actual use levels in organic farming and how it compares to other types of farming has been very limited.

**ANTIBIOTIC USE ON SOIL ASSOCIATION CERTIFIED FARMS**

To remedy this problem a survey was carried out of Soil Association certified livestock farmers to determine average levels of antibiotic use. In total 248 farmers consented to take part and data was successfully obtained from their vets for 211 of these farms. Of these, 57 farms reported having dairy cattle, 119 had beef cattle, 93 had sheep, 18 had pigs, 14 had 50 or more laying hens, six had 40 or more broiler chickens and one had turkeys.

In this sample, antibiotic use per livestock unit on Soil Association dairy farms was:

- Over four times lower than the national average overall
- On dairy farms it was less than half the level found in a national survey of dairy farms
- On beef farms it was less than a third of the level found in a national survey of beef farms
- On sheep farms it was less than a fifth of the level found in the most recent large survey of sheep farms.
- On pig farms it was less than one 75th of the national average published by the pig industry
- On boiler-chicken farms it was less than one fifth of the national average published by the poultry industry.
- There was no antibiotic use on any of the layer farms or on the turkey farms.

The small sample sizes for the Soil Association pig and poultry farms make these figures less reliable and less statistically significant, but they are nevertheless consistent with the very low levels of use found on organic pig and chicken farms by a Defra study published in 2006.

Despite the low level of antibiotic use found in this survey, significant differences were found in the use of antibiotics between different farms. This suggests that further reductions in average use in organic farming remain possible.

**REASONS FOR LOW USE OF ANTIBIOTICS ON ORGANIC FARMS**

Interviews with Soil Association farmers revealed that many of them considered cleanliness to be the most important factor for maintaining good animal health and thought that the best way to achieve this was to minimise the period when animals are kept indoors during winter and to move livestock as frequently as possible to fresh ground. Other important husbandry factors mentioned that contributed to good animal health included a low stocking rate, a low-stress environment, good nutrition, later weaning of piglets and breeding specifically for health traits rather than just for productivity.

Restrictive organic rules on antibiotic use, and in the case of dairy farming the introduction of some "produced without antibiotics" contracts, also help minimise use.

Similarly, scientists comparing the much lower level of antibiotic use in Danish organic pigs compared with non-organic pigs said that they suspected that "not only strict regulations on antibiotic usage but also improved health related to conditions like being born outdoor[s], higher weaning age and lower stocking density have an effect on antibiotic usage."

**LESSONS FOR ALL FARMERS**

Scientists in Denmark have also found much lower antibiotic use in organically farmed animals and said that non-organic farming could learn from organic farming's restrictive rules and husbandry practices and that some regulatory changes may also be needed to reduce antibiotic use in non-organic farming.

Similarly, in the UK, there is very large potential for British non-organic farming to learn from organic farming. Non-organic farmers should consider adopting some of the husbandry practices of organic farming which help minimise disease and antibiotic use.

In 2019, overall UK farm antibiotic use increased by 3% and this was partly due to disease problems. Both the pig and poultry industry continue to rely on extremely high use of alternative medication, such as coccidiostats in poultry feed and zinc oxide in piglet feed, to control widespread disease problems. By adopting some of the practices of organic farming many of these disease problems can be minimised.

The government and its regulators should also learn from organic farming and raise minimum husbandry standards for all farming to ensure that disease-causing practices associated with high antibiotic use are phased out.

This experience has heightened concerns about future pandemics and raised awareness that we need to "build back better" if we are to avoid similar disease problems in the future[1].



## Antibiotic use in organic farming compared with UK average

Average (Non-organic)
Organic

| | UK average 2019 (mg/pcu) | Soil Association Organic 2019 (mg/pcu) | | |
|---|---|---|---|---|
| OVERALL | 31 | 7.46 | SA Organic sample is 4x lower than UK average | SA Organic sample is 76% less than average |
| DAIRY | 22.5 | 10.66 | SA Organic sample is 2x lower than UK average | SA Organic sample is 53% less than average |
| BEEF | 24.5 | 7.22 | SA Organic sample is 3.5x lower than UK average | SA Organic sample is 70% less than average |
| SHEEP | 16.7* | 3.33 | SA Organic sample is 5x lower than UK average | SA Organic sample is 80% less than average |
| PIGS | 110 | 1.42 | SA Organic sample is 77x lower than UK average | SA Organic sample is 99% less than average |
| BROILERS | 17 | 2.95 | SA Organic sample is 6x lower than UK average | SA Organic sample is 80% less than average |
| TURKEYS | 42 | 0 | / | / |
| LAYERS | 0.68 | 0 | / | / |

*Up-to-date sheep data not available from VARSS. We've sourced the figure used above for sheep, here: **https://aacting.org/swfiles/files/Fiona%20Lovatt_77.pdf**

# 1 .INTRODUCTION

The current Covid pandemic has demonstrated how large an impact infectious disease can still have on the modern world. A lack of reliable and effective treatments for infections caused by the SARS-CoV-2 virus has led to millions of deaths. Lockdowns have resulted in social isolation for millions and have had a major economic toll which is yet to be calculated.

Another looming pandemic that scientists have been warning of for years is antibiotic resistance[2]. The rise of antibiotic resistance means that antibiotics, our most important medicines, are losing their effectiveness for treating a wide range of bacterial diseases. This is a global crisis which experts warn threatens a century of progress in health and the achievement of Sustainable Development Goals [3].

Antibiotic-resistant infections already kill 700,000 people a year worldwide, and according to the UK's Antimicrobial Resistance Review, if we continue with business as usual 10 million people a year could die of antibiotic resistance worldwide by 2050 [4]. Scientists say that the overuse of antibiotics in both human medicine and livestock farming contribute to the spread of antibiotic resistance in human infections [3].

Fortunately, action is being taken to reduce antibiotic use and in the UK the sales of veterinary antibiotics fell by 49% between 2014 and 2018 as industry introduced new voluntary actions and standards [5]. This reduction in antibiotic use has already led to falls in antibiotic resistance in Escherichia coli bacteria in livestock [5, 6]. This is extremely welcome since no genuinely new antibiotics have been discovered for treating E. coli infections in over 40 years.

However, in 2019 British veterinary antibiotic sales increased by 3%, the first increase in use in five years. Levels of antibiotic use remain unsustainably high, particularly in the pig industry. According to the pig industry one explanation for the failure to significantly reduce antibiotic use in 2019 has been high levels of swine dysentery [7]. This a severe bacterial infection which spreads when pigs ingest infected faecal matter, which is more likely to occur in unhygienic conditions.

While farmers efforts to reduce their reliance on routine antibiotic use have been extremely welcome, if further, necessary reductions in antibiotic use are to be achieved, controlling or eliminating widespread disease problems will be necessary. This raises the question of whether husbandry and the conditions in which animals are kept needs to significantly improve.

In the UK some animals which are farmed non-organically are nevertheless kept outdoors, in fields, particularly in the case of sheep and cattle farming but also for some pigs and poultry farming. However, most pigs and poultry are farmed much more intensively and are kept indoors their entire lives, in cramped, unhygienic conditions where disease spreads more easily and where the reliance on some form of medication can be routine. There is also a trend towards more industrial, feedlot-type

systems in cattle farming [8]. Feedlots are common in the United States where there is very high antibiotic use in cattle [9].

The organic sector, however, has long argued that a less intensive form of farming, such as that promoted by organic standards, can help reduce disease problems. Access to the outdoors and lower stocking densities (fewer animals per area) as required in organic farming often reduce disease transmission between animals, just as social distancing and being outdoors reduces the transmission of Covid in humans. Low levels of stress, appropriate diets, the use of more resilient breeds and the requirement for pigs to remain with their mothers for longer before being weaned can also reduce illness and the need for antibiotics and other treatments.

However, while it is recognised that organic farming already implements many of husbandry practices associated with low disease, and although it also has stronger restrictions on antibiotic use than non-organic farming, there is still a lack of hard data showing that use levels are in fact lower.

For this reason, the Soil Association and the George Farm Vets veterinary practice have teamed up to collect antibiotic-usage data from organic farmers certified by the Soil Association. This work has been supported by the Alliance to Save Our Antibiotics and is a first attempt to provide a convenience sample of the level of antibiotic use in organic farming in the UK.

It is hoped that this work will provide evidence that further large cuts in antibiotic use can be achieved and that making these reductions is likely to require some of the approaches being used in organic farming to be used more widely.

# 2. REDUCTIONS IN ANTIBIOTIC USE IN BRITISH FARMING

As the issue of antibiotic resistance has risen up the national and international agenda, there has been an increased focus on farm antibiotic use. Globally, livestock accounts for an estimated 73% of all antibiotic use, although the percentage in the UK is lower at around 30% [10,11].

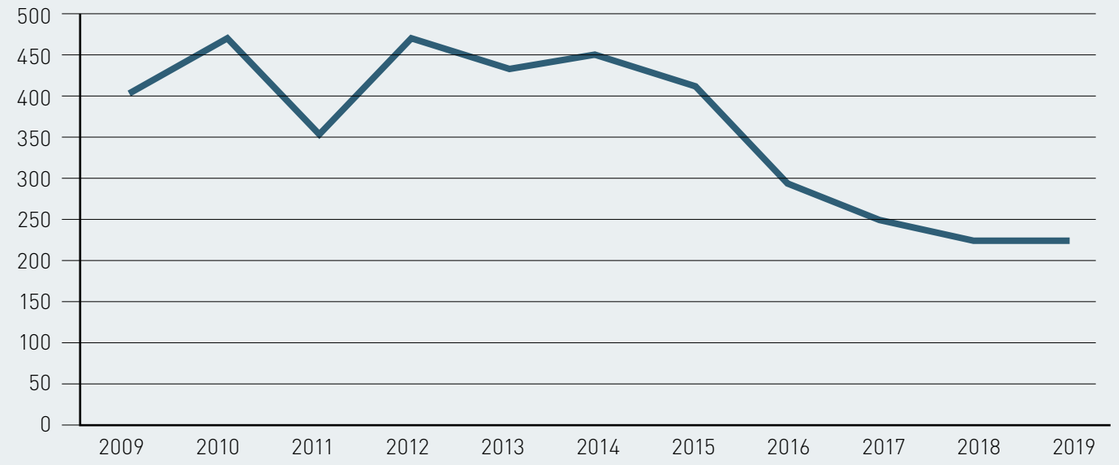
In 2015, the Review on Antimicrobial Resistance [4] established by the British government published a report calling for global reductions in farm antibiotic use, and the following year the 71st General Assembly of the United Nations issued a Political Declaration on antimicrobial resistance calling for action [12]. The European Union also made it clear that farm antibiotic use was too high and new restrictions on preventative use were proposed by the Commission in 2014. These restrictions were strengthened by the European Parliament in 2018 and will come into force in the EU, but perhaps not the UK, on 28 January 2022 when all preventative group treatments with antibiotics will be banned [13].

These developments, and increasing media coverage of the problem, have put pressure on farmers to make changes. Farming and veterinary organisations decided that they needed to take the initiative and have implemented voluntary reductions in use [14]. The industry body, Responsible Use of Medicines in Agriculture (RUMA), which brings together farming and veterinary organisations and the pharmaceutical industry, has introduced new antibiotics guidelines which discourage routine antibiotic use [14], but unfortunately it still does not support banning preventative mass medication.

Poultry producers represented by the British Poultry Council (BPC), however, stopped using antibiotics preventatively in 2016, and Red Tractor standards for poultry were subsequently updated to prohibit such use, which has contributed to large reductions in antibiotic use in poultry. The National Pig Association (NPA), like RUMA, continues to support allowing preventative use, although it too discourages routine use, and antibiotic use in the pig industry has been cut significantly. Both the BPC and the NPA now collect and publish antibiotic-usage data, and this too has motivated some farmers to cut their antibiotic use.

In addition, supermarkets have introduced new policies aimed at reducing antibiotic use and a campaign led by the Alliance to Save Our Antibiotics has led to improvements in these supermarket standards and more data on supermarket antibiotic use being published [15].

**Graph 1**
**Antibiotic active ingredient (tonnes) sold in the UK for veterinary use, 2009 to 2019** [6]




All of these pressures and actions have contributed to UK farm antibiotic use being cut by nearly 50% between 2014 and 2018, although use increased again by 3% in 2019, see Graph 1.

However, the failure to cut antibiotic use in 2019 is of concern, as overall use remains far too high. Antibiotic use in chickens, for example, has increased from a fairly low level of 10 mg of active ingredient per kg of livestock unit in 2017 to 17.5 mg/kg in 2019. Note that the livestock unit used is the European Union's "Population correction unit" which is widely used in the UK and the EU when comparisons are made between antibiotic use levels in different livestock populations.

Use in pigs has remained at a very high level of 110 mg/kg in 2018 and 2019, although this is still a reduction of about 60% on the levels in 2015 and industry data suggests that use in the first half of 2020 fell to 104 mg/kg[16]. While this is still a lot lower than use in some other countries, it remains more than 2.5 times higher than in Denmark and the Netherlands and nine times higher than in Sweden, see Table 1.

**Table 1**
**Antibiotic use in pigs in countries where data available (mg of active ingredient per kg of Population Correction Unit)** [17]

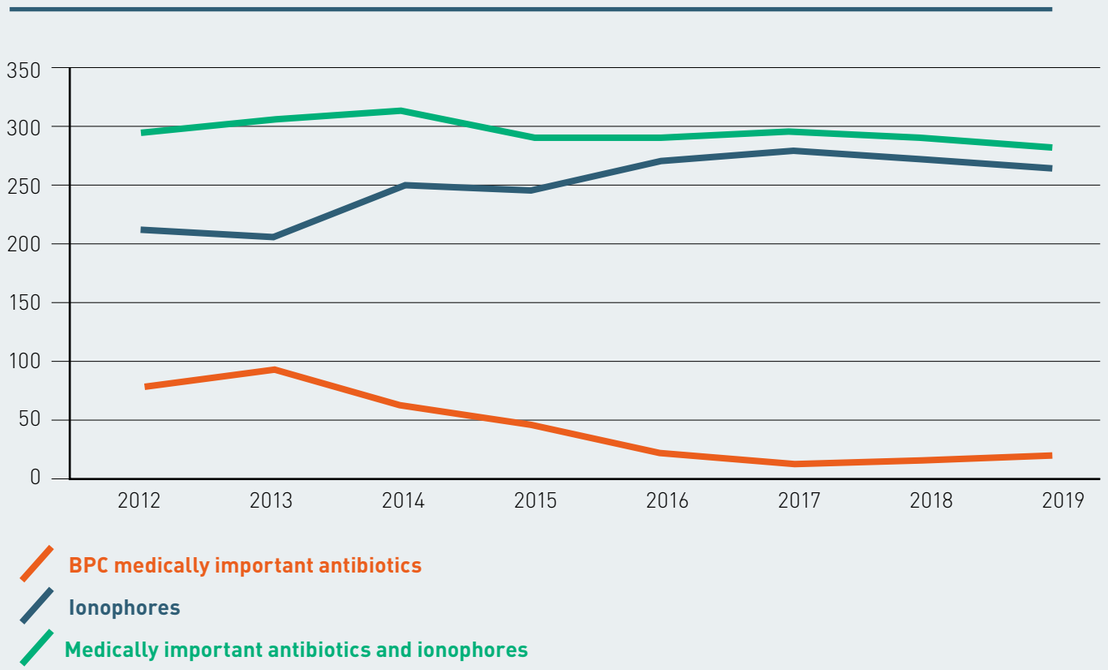
| | |
|---|---|
| China (2012) | 593 |
| Australia (2010) | 293 |
| US (2019) | 280 |
| Ireland (2016) | 162 |
| UK (2019) | 110 |
| Austria (2018) | 106 |
| France (2019) | 78 |
| Denmark (2019) | 41 |
| Netherlands (2019) | 40 |
| Sweden (2019) | 12 |

Nevertheless, the major reduction in British farm antibiotic use is very welcome and already seems to have had an effect on reducing antibiotic resistance levels in British pigs and chickens. EU-mandated harmonised testing of Escherichia coli bacteria from chickens and pigs at slaughter has found falling levels of antibiotic resistance between 2014 and 2019 [5,6].

Some of this reduction in use has come about through increased awareness of the need for reductions from farmers and veterinarians and improvements in industry guidance. There has been far greater emphasis on avoiding routine use and less reliance of using antibiotics preventatively, particularly in the poultry industry.

However, husbandry practices have not fundamentally changed as intensive farming remains dominant in pig and poultry production. As a result, certain diseases remain routine and to control them there has been increased reliance on the use of alternative medication. Below we examine two alternatives to medically important antibiotics which are widely used in poultry and pig production.

**Graph 2**
**Use of medically important antibiotics by the BPC and ionophore sales in poultry, 2012 to 2019 [18,19]**






## IONOPHORE USE IN POULTRY

In the poultry industry, there is extremely widespread use of coccidiostat antimicrobials which are used to control the intestinal disease coccidiosis and can be routinely added to poultry feed without the need for a veterinary prescription. Coccidiosis only occurs when chickens ingest chicken droppings. This is a major problem in intensive chicken production where tens of thousands of birds can be kept permanently indoors in a single shed with a space allowance of less than an A4 sheet of paper per animal.

The most widely used coccidiostats are antibiotics called ionophores. Ionophores are not counted in antibiotic usage data because they are not considered medically important as their toxicity means they are not used in humans. Graph 2 shows that ionophore use in poultry is extremely high and, as the use of medically important antibiotics has reduced since 2013, the use of ionophores has increased significantly. The overall use of antibiotics, those that are medically important and the ionophores, which are not classified as medically important, has remained very constant although it was 3% lower in 2019 than in 2012. This is of concern as it shows that poultry remain highly medicated due to unsanitary conditions in which many intensively farmed birds are kept.

The overuse of ionophores may also be creating unwanted antibiotic resistance. There is evidence that the use of ionophores helps select for certain bacteria in poultry which are resistant to medically important antibiotics. The ending of ionophore use in Norway appears to have had a substantial effect in reducing the incidence of these bacteria in Norwegian poultry [20].

There are also increasing suggestions from scientists that, despite their apparent toxicity, ionophores could be developed for use in humans in the future [21]. A very recent study in Nature Chemistry reported on the development of an ionophore that retained good antibacterial activity while having reduced toxicity against human cells. The scientists said "our study suggests the exciting prospect of optimizing polyether ionophores for use as antibiotics [in humans]" [22].

If ionophores are developed as human antibiotics they may need to become prescription-only antibiotics in the future which would mean that the current reliance on routine use in farming would no longer be possible. Other non-antibiotic coccidiostats are also available, but without the ionophores controlling coccidiosis through medication would become significantly more difficult. In such a situation, greater efforts would need to be made to avoid routine coccidiosis problems by improving husbandry and the conditions in which poultry are kept, so that ingestion of chicken droppings is avoided. Avoiding routine coccidiosis problems is achieved in organic farming by regularly moving animals to clean pasture avoiding the build-up of parasites.

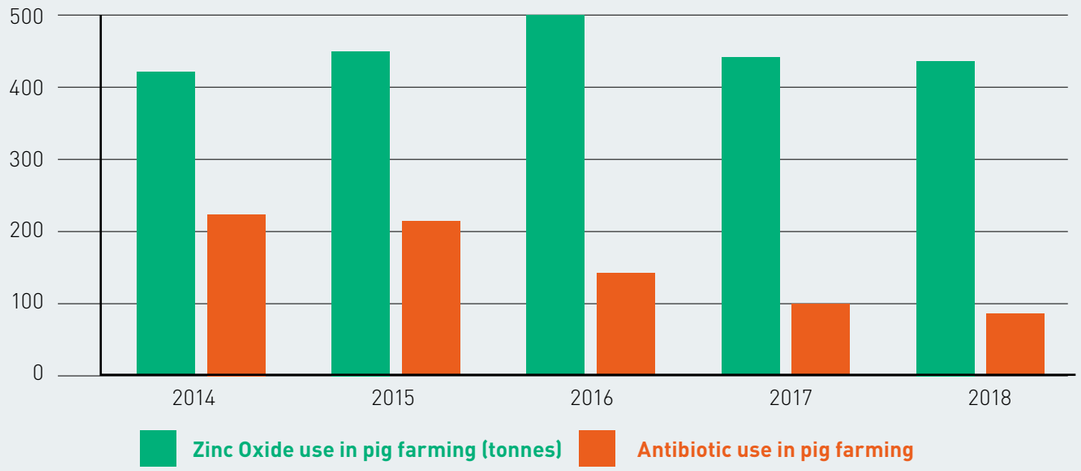
## ZINC OXIDE USE IN PIGS

The pig industry also relies on the use of routine medication with feed additives other than antibiotics, particularly for weaner piglets. Antibiotic use tends to be highest in piglets that have recently been weaned as these medicines help control post-weaning diarrhoea, an infection which is particularly common when piglets are weaned too early [23]. In non-organic farming, piglets can be weaned at just 21 days whereas in organic farming the minimum weaning age is 40 days.

However, pig farmers can also use zinc oxide in piglet feed after weaning, in addition to or as an alternative to antibiotics, in order to control post-weaning diarrhoea. An estimated 70-90% of British piglets receive this additive in their feed at weaning time [24]. As antibiotic use in the pig industry began to reduce after 2014, use of zinc oxide increased to record levels in 2016.

Unfortunately, using zinc oxide is environmentally damaging as the substance is not biodegradable and when pig manure is spread on land high levels of zinc can accumulate and harm soil. For this reason, in late 2016 it was revealed that the EU was likely to ban the use of therapeutic doses of zinc oxide in piglet feed [24], and the decision to ban such treatments in June 2022 was confirmed in June 2017 [25]. It appears that the UK will also be implementing this ban[26], and the knowledge that zinc oxide needed to be

**Graph 3**
**Use of antibiotics and zinc oxide in pig industry (tonnes active ingredient), 2014 to 2018***




phased out may have contributed to the use of the substance in piglet feed falling somewhat in 2017 and 2018, see Graph 3.

There is also evidence that the use of zinc oxide can increase the incidence of certain antibiotic-resistant bacteria in pigs, which is another reason why its long-term use is not sustainable [27].

In 2016 the pig veterinarian David Burch, who was also a consultant to the pharmaceutical industry, told Farmers Weekly that a ban on zinc oxide could hinder efforts to reduce antibiotic use, although he also said it would mean that piglets would have to be weaned two weeks later [24].

Unfortunately it seems that many pig farmers are not yet preparing for later weaning or other husbandry improvements. A recent survey of pig farmers by Farmers Weekly found that 60% of them have no plan in place for when zinc oxide is banned, and most thought that antibiotic use was likely to increase 28. This highlights the need for improvements in husbandry, such as later weaning, reductions in stocking density and stress levels, and improvements in diets.

* Data on zinc oxide use has been obtained from the Veterinary Medicines Directorate (VMD) via Freedom of Information requests. Data on antibiotic use in the pig industry is estimated based on VMD sales data reports and data from the pig industry.

# 3. ORGANIC STANDARDS AND ANTIBIOTIC USE

A key principle of organic farming is to prevent disease through good husbandry, appropriate breeds and good diet, rather than through the routine use of preventative medication.

In contrast to the situation in the US where all antibiotic use is banned in organic livestock, in the UK and the EU the restricted use of antibiotics is permitted in organically certified livestock to ensure that animal welfare is not undermined and that treatment is provided where needed.

Below we outline the key standards on antibiotic use in British organic farming as well as some of the key husbandry practices of organic farming which aim to minimise stress and disease in livestock

## ORGANIC STANDARDS FOR ANTIBIOTIC USE

The EU has set certain minimum standards that all organically certified farmers must meet. These standards are still applicable in the UK and are set out by Commission Regulation No 889/2008. The key restrictions on antibiotic use in the Regulation are:

- Antibiotics cannot be used preventatively in the absence of disease or surgical intervention.
- The organic withdrawal period for all antibiotic medication is double the statutory withdrawal period. During the withdrawal period, animals cannot be slaughtered for human consumption and milk and eggs cannot be collected for human consumption.
- Animals cannot be sold as organic if they receive more than three courses of antibiotics in 12 months, or more than one course if their lifecycle is less than one year.
- When treating a sick animal, plant-based medicines, homeopathic medicines, trace elements, vitamins and minerals should be used in preference to antibiotics or other allopathic medicines. If, however, these alternative treatments are inappropriate or ineffective, allopathic medicines or antibiotics must be used.
- In addition to meeting these minimum standards, organic certifiers are permitted to set higher standards for their licensees.

The Soil Association has long focused on ending inappropriate antibiotic use and for many years it led a campaign to end all misuse of antibiotics in farming [29]. As a leading member of the Alliance to Save Our Antibiotics it continues to work towards this end. This campaign work has raised the Soil Association's awareness of the importance of certain antibiotics in human medicine and of the dangers of certain practices in farming. As a result, the Soil Association has established the following higher standards which apply to Soil Association licensees [30]:

- Fluoroquinolone and modern cephalosporin antibiotics, which are classified by the World Health Organization as high-priority critically important antibiotics in human

medicine, should not be used except when no other treatment would be effective. This is due to evidence that the overuse of these antibiotics in livestock has contributed to higher levels of resistant infections in humans.

- The antibiotic colistin, which is used as a last-resort in human medicine for treating certain highly antibiotic-resistant infections, cannot be used at all due to the evidence that colistin-resistant bacteria may transfer from farm animals to humans.

- Calves on dairy farms cannot be fed milk taken from cows during the statutory withdrawal period for antibiotic treatments. Such "waste" milk can contain antibiotic residues and feeding this milk to calves, as often occurs on dairy farms, can promote antibiotic resistance in calves.

## ORGANIC STANDARDS AND DISEASE PREVENTION

Organic standards aim to promote good health and welfare so that disease is exceptional rather than routine. By aiming to minimise disease, these standards are also likely to reduce the need for antibiotic treatments. When some of these approaches are adopted they may also reduce infections and antibiotic use.

Some key organic standards include:

- **Access to the outdoors.** Organic farming is an extensive system of farming and aims to keep animals outside and on pasture whenever weather and environmental conditions allow. All herbivore and poultry species must have permanent access to pasture unless circumstances such as weather or the health of the animal prevent this. Under higher Soil Association standards, this also applies to pigs.

  Keeping animals on pasture will often help reduce disease incidence in comparison to intensive, indoor systems. According to the European Food Safety Authority (EFSA) and the European Medicines Agency (EMA) "The stress associated with intensive, indoor, large scale production may lead to an increased risk of livestock contracting disease" and that these kind of farming practices can mean that "much reliance is placed on the routine use of antimicrobials for disease prevention or for the treatment of avoidable outbreaks of disease" [31]. For example, a Belgian study found that veal calves raised intensively indoors had a treatment incidence with antibiotics that was about 25 times higher than beef cattle reared extensively [32].

- **Lower stocking density.** When organic animals are housed indoors, during poor weather for example, the stocking density (the number of animals per area of housing) must be kept at much lower levels than for intensive farming. In intensive chicken farming up to 38 kg of bird can be kept per square meter, whereas for free-range birds the limit is 27.5 kg/m2 and for organic birds it is 21 kg/m2 for fixed housing and 30 kg/m2 for mobile housing.

  Higher stocking densities can limit natural behaviour, promote stress and allow disease to spread more easily, and the increased risk of wet litter can lead to footpad dermatitis and higher levels of harmful ammonia concentrations in chicken housing, which all impact on welfare. According to the EMA and EFSA, higher stocking densities have been associated with increased preventative use of antibiotics due to the expectation of increased disease [31].

  Use of appropriate, resilient breeds, including slower-growing chickens. The breeds used in organic farming should have good disease resistance and be able to adapt to local conditions. They should not have specific health problems associated with some breeds used in intensive systems. In particular, broiler chickens (those raised for meat) must be from slower-growing breeds or be raised until they are at least 81 days.

  In intensive systems, broiler chickens are so fast growing they can be slaughtered when they are just 32-40 days old [33,34]. This extremely fast growth is associated with welfare problems and higher mortality [35]. There is also evidence that slower-growing birds have less need for antibiotics. In the Netherlands, approximately one third of broilers are slower-growing breeds with two thirds being fast-growing and industry data shows that the fast-growing birds received about six times more antibiotics per bird than the slower-growing birds in 2019 [36].

- **Later weaning.** Organically farmed piglets cannot be weaned before they are at least 40 days old, whereas those that are non-organically farmed can be weaned at just 21 days. Weaning is very stressful for piglets and when they are weaned early there is an increased likelihood of post-weaning diarrhoea, which is then often treated with antibiotics [23]. Later weaning can greatly reduce this problem. Organic rules also set a minimum weaning age for bovines of 3 months and for sheep of 45 days.

  A study comparing antibiotic use on 227 pig farms in four EU countries found that at weaning time piglets in France, Belgium and Germany received between 20 to 30 times more antibiotics than piglets in Sweden did. This large difference was likely due to the later average weaning age in the Swedish piglets (35 days) compared with France, Belgium and Germany where the piglets were weaned on average between 22 and 25 days [37].

- **Appropriate diets.** Diets for organically farmed animals should contain sufficient roughage. Organic rules require that pigs' and poultry's daily rations contain some roughage. The diets for herbivores must be based on maximum use of pasture. At least 60% of the dry matter of daily rations for herbivores must be roughage. High levels of grains in the diets of cattle can cause acidosis which can require antibiotic treatment.

# 4. ANTIBIOTIC USE IN ORGANIC FARMING COMPARED WITH NON-ORGANIC FARMING

Since late 1990s, the government's Veterinary Medicines Directorate (VMD) has collected data on the sales of veterinary antibiotics from pharmaceutical companies, which it has published in annual reports [38].

Sales data provides a good idea of the scale of farm antibiotic use and of the trends. However, because many antibiotic products are sold for use in more than one species, and since pharmaceutical companies are not always sure how the antibiotics are being used, a full breakdown of use by species has not been possible from this data.

Furthermore, the VMD reports provide no information on antibiotic use in different farming systems, such as intensive, free-range, pasture-fed or organic.

The VMD data has shown that antibiotic use has generally been highest in pigs and poultry, the two most intensively farmed species in the UK. The VMD used to provide an estimated breakdown of usage between these two species based on its sales data.

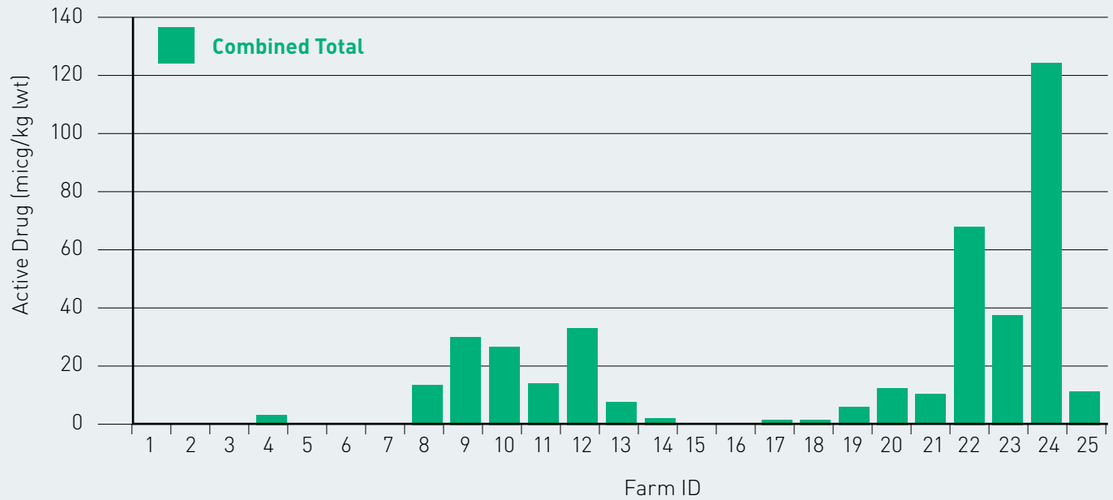
However, from 2012 onwards the British Poultry Council (BPC) has been voluntarily collecting its own usage data from its members and has reported this data annually [18]. BPC members represent about 90% of the poultry meat sector (chickens, turkeys, ducks, geese). In addition, since 2015 the Agriculture and Horticultural Development Board Pork (AHDB Pork) has been voluntarily collecting and publishing data on the use in the pig sector, which covered 95% of the industry in 2019 7.

## LIMITED DATA FOR ORGANIC FARMING

Unfortunately, while the pig and poultry industries now have much more precise information on antibiotic usage on individual farms, they only publish a single overall figure each year and do not attempt to provide any estimate of use by farming system.

As a result there is still a lack of information on antibiotic use in less intensive farming systems. Up until now, the only information available on antibiotic use on organic farms in the UK has been from a Defra study published in 2006. This study examined antibiotic use on seven organic poultry farms and five organic pig farms with six non-organic poultry farms and seven non-organic pig farms. It found much lower levels of antibiotic use on the organic farms: whereas all the non-organic farms used antibiotics, six of the seven organic poultry farms and two of the five organic pig farms did not use antibiotics at all during the entire two-year study, see Graph 4 [39].

**Graph 4**
**Use of antibiotics (microgramme of active ingredient per kg of meat produced) on British organic poultry (1 to 7) and pig (14-18) farms compared with British non-organic poultry (8-13) and pig (19-25) farms [39]**




The much lower levels of antibiotic use on the organic farms were reflected in the lower levels of resistance. The E. coli taken from the poultry farms were tested for their resistance to ten different antibiotics. The median number of antibiotics to which the E. coli from the organic poultry farms were resistant was just one, whereas for the non-organic poultry farms it was five.

Research funded by the Scottish Executive published in 2000 also found much lower levels of resistance in organic pigs than in non-organic pigs. On intensive farms, it was found that resistance in E. coli was 'widespread', with resistance to tetracycline being particularly high, at 'up to 100% in pigs prior to slaughter'. In contrast, they found that on small organic pig farms there were much lower levels of carriage of resistant E. coli (0-10%) [40]. However, this study did not include any information on actual antibiotic use.

For dairy farming the only UK study to compare antibiotic use on organic and non-organic farms was a Defra study published in 2012 [41]. It did not provide an overall usage figure, but found that the use of dry-cow antibiotic tubes at the end of the lactation was much more common in non-organic farms. In total 85% of non-organic farms used them on all of their cows at drying off whereas this was the case for just 5% of organic farms. Since this study was carried out, efforts have been made in both organic and non-organic farming to reduce the use of antibiotic dry-cow therapy [6,42].

## ANTIBIOTIC USE ON SOIL ASSOCIATION CERTIFIED FARMS

Because of the very limited data publicly available on antibiotic use on organic farms, the Soil Association decided to carry out data collection from its licensees, and the Alliance to Save Our Antibiotics supported this work.

The Soil Association distributed consent forms to their licensees, asking for their permission for their vet to provide details of all antibiotics sold or prescribed between 1/6/18 and 31/5/19. Data on livestock numbers was also requested. The data was then processed by The George Farm Vets practice who also produced a report on the findings [43].

A total of 211 farms successfully contributed data. 57 farms reported having dairy cattle, 119 had beef cattle,

93 had sheep, 18 had pigs, 14 had 50 or more laying hens, 6 had 40 or more broilers and 1 had turkeys. More farms gave consent, but in some cases it was not possible to obtain the necessary information from their vets, or there were errors in the consent forms.

To make the results comparable, the data has been presented in terms of milligrams of active ingredient per kg of "population correction unit" (PCU). The PCU is a technical livestock unit introduced by the EU estimating the average weight of an animal at treatment time.

The PCU, however, has a number of peculiarities, including the fact while live adult dairy cows have a PCU of 425 kg, only slaughtered animals count towards the PCU of a beef farm so that live adult beef cows have zero PCU. If all adult cows on beef farms produce one calf per year, this point is perhaps not important as it applies similarly to all beef farms, but for some organic herds, for example those engaging in conservation grazing, there can be substantially more adult cows on a farm than calves. In such cases using the PCU will underestimate the real size of the livestock population and therefore overestimate the use of antibiotics per livestock unit.

For this reason it was thought reasonable to assign a PCU weight to older live animals on beef farms when calculating the size of the livestock population. Using this second method for calculating the livestock population of a beef farm, a different figure is obtained for antibiotic use per livestock unit. This second method has been included in brackets after the figure using the PCU in Table 2.

Egg-laying hens also have no PCU weight, so the antibiotic-usage data for egg layers is given in terms of doses of antibiotic per bird days.

The results comparing antibiotic use by Soil Association farmers with national averages are in Table 2 below.

As Table 2 shows, the average antibiotic-use level in this sample of Soil Association licensees is well below the national averages in each species, despite the nearly 50% reduction in the national usage in the past few years. The sample is a "convenience sample" of farmers, meaning that it cannot necessarily be taken to be fully representative of all Soil Association farmers since the sample was not randomly selected but simply includes data from farms that consented to take part.

Usage is particularly low for pigs, poultry and sheep, although it is important to note the very small sample sizes for pigs and poultry which make the data less reliable. It is however worth noting that the particularly low usage in pigs and broilers is consistent with the findings of the Defra study referred to above.

Though average use of antibiotics across this dataset is significantly lower than national average figures, there were some large differences in usage between different farms within one sector.

In common with datasets referenced by the industry group RUMA [45], the median figure tends to be much lower than the mean. In both organic and non-organic sectors, a small number of heavy users of antibiotics are noticeable and they push up the mean figure considerably. The highest users in dairy, beef, sheep and pigs have a small number of animals relative to their peers (20 cows, 11 beef calves, 8 sheep and 8 breeding pigs respectively) and are not particularly representative. However, there are similar-sized enterprises with zero antibiotic use, and many of the other heavy users are large or medium-sized commercial farms.

The finding that some farms are using considerably more antibiotics than others shows that, despite the already low average use being achieved, there remains room for further reductions in use in organic farming.

The large differences between the organic and non-organic use levels show that further large reductions in use in non-organic farming remain achievable and that organic farming is a model from which non-organic farmers can learn.

To further examine the reasons for the low antibiotic use in organic farming and the husbandry practices which help maintain good health, qualitative interviews were carried out with some licensees and the findings are presented in Chapter 4.

**Table 2**
**Antibiotic use on organic farms certified by the Soil Association compared with non-organic national averages by species (mg of active ingredient per kg of PCU and doses per bird days for layers)**

| | Overall | Dairy | Beef | Sheep | Pigs | Broilers | Turkeys | Layers |
|---|---|---|---|---|---|---|---|---|
| National average** | 31 | 22.5 | 24.4 | 16.7 | 110 | 17 | 42 | 0.68 |
| Soil Association average | 7.46 | 10.66 | 7.22 (2.95) | 3.33 | 1.42 | 2.95 | 0 | 0 |
| Soil Association farm median | | 6.98 | 3.97 (1.64) | 2.04 | 0.19 | 0 | 0 | 0 |

**National averages for all species except sheep are for 2019 and are taken from the VMD's VARSS report [6]. For sheep it is taken from a 2017 survey of 152 sheep-only flocks[44].

## ANTIBIOTIC USE IN DANISH ORGANIC LIVESTOCK

Since 2000, the Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (DANMAP) has collected antibiotic-usage data from every farm in Denmark. National data by species is published in annual reports but unfortunately no information in these reports is given on antibiotic use by farming system [46].

However, in 2014, in response to a question in Danish Parliament, the Danish government did publish information on antibiotic use in organic pig production compared with non-organic pig production[47].

It is worth noting that in Denmark, unlike in the UK, preventative mass medication with antibiotics is not permitted by law in any type of farming system. This partly explains why the national average for antibiotic use in Danish pigs is 2.7 times lower than in the UK (see Table 1, Chapter 2).

Despite antibiotic use in Danish pigs generally being lower than in the UK and in most European countries, the data published by the Danish government showed that antibiotic use in organic systems was ten times lower per animal, see Table 3. At weaning time, when antibiotic use is by far the highest in intensive systems, it was 20 times lower.

**Table 3**
**Antibiotic use in organic and non-organic pigs in Denmark in 2013 (number of doses per 1,000 animal days)**

| | Organic | Non-organic | Non-organic/ organic ratio |
|---|---|---|---|
| Sows and piglets | 4.1 | 23.5 | 5.7 |
| Weaner piglets | 4.6 | 94.4 | 20.5 |
| Slaughter pigs | 5.1 | 18 | 3.5 |
| Overall | 4.8 | 51 | 10.6 |

In a very recent study Danish scientists have again used the national database to compare antibiotic use in Danish organic pigs with use in free-range non-organic pigs and indoor non-organic (mainly intensive) pigs [48]. While their study does not include an overall figure, they also found much lower antibiotic use in organic pigs at all stages of their lives. Use in sows and piglets (before weaning) and in weaning piglets was 15 times higher in indoor pigs than in organic pigs and use in slaughter pigs was nearly 4 times higher, see Table 4. This study also included data on antibiotic use in non-organic free-range pigs and found significantly lower levels than in indoor

**Table 4**
**Antibiotic use in organic, non-organic free-range and indoor (intensive) pigs in Denmark in 2016-2018 (number of doses per 1000 animal days) [48]**

| | Organic | Free-range non-organic | Indoor (intensive) | Indoor/organic ratio |
|---|---|---|---|---|
| Sows and piglets | 1.1 | 4 | 16.5 | 15 |
| Weaner piglets | 4.8 | 33.7 | 72 | 15 |
| Slaughter pigs | 2.88 | 8.2 | 10.5 | 3.75 |

pigs, but still significantly higher than in organic pigs. All organic and higher-welfare pig farms with a minimum number of pigs were included in the study and their usage was compared with usage on a random sample of 300 indoor pig farms.

The much lower use of antibiotics in organic weaner piglets is likely to be at least partly due to the much later weaning that occurs in organic farming. Organic piglets can only be weaned at 40 days, whereas the intensive piglets can be weaned at 21 days and those raised in the Danish free-range system can be weaned at 30 days. However, in Denmark all three systems also currently use zinc oxide and no statistically significant differences in the use of this feed additive were found between the systems.

Other husbandry factors which distinguish the "higher-welfare" organic and free-range systems from the indoor system in Denmark include the fact that piglets are born outdoors and continue to have outdoor access during their growing and finishing periods. When kept indoors these higher-welfare systems also must provide bedding whereas intensively farmed pigs are usually kept on fully slatted floors. There is also a requirement for more room per pig indoors (0.65 m2 per pig in intensive farming, 1.2 m2 in free-range and 2.3 m2 in organic).

The scientists concluded that the better conditions in which the organic and free-range pigs are kept was likely to be an important factor in the lower levels of antibiotic use alongside the stricter regulations on antibiotic use. They said:

"From our findings, it seems logical to suspect, that not only strict regulations on antibiotic usage but also improved health related to conditions like being born outdoor[s], higher weaning age and lower stocking density have an effect on antibiotic usage. Different conditions with respect to human supervision and possibilities for intervention could also play a role, as well as differences in treatment threshold."

They also indicated that lessons could be learned from the low levels of antibiotic use in higher-welfare systems saying:

"The lower level of antibiotic usage in welfare-label systems indicates that a significant reduction in antibiotic use in pig production would require housing and management changes or regulatory changes in the conventional indoor system."

The study also found large variations between different farms in each of the three systems. This is consistent with what has been found in the UK, and shows that even though use is much lower in organic farming, further reductions in use remain possible for higher organic users.

While neither of the above Danish comparisons between organic and non-organic pigs provided antibiotic-use data in terms of milligrams of active ingredient per kg of PCU, it is worth noting that national average for antibiotic use in Danish pigs in 2019 was about 41 mg/kg [46] whereas in the UK it was 110 mg/kg.

If from the two above Danish organic datasets we estimate that antibiotic use in Danish organic pigs is about 10 times lower than the national average, then it appears that use in Danish organic pig farming is about 4–5 mg/kg. This is of the same order of magnitude as the 1.42 mg/kg found in the survey of Soil Association certified pigs.

Another Danish study, published last year, used the national data on antibiotic use to compare organic and non-organic dairy farming [49]. It found that in both types of systems most antibiotic use was in adult dairy cows rather than in the calves and that in dairy cows 70–75% of treatments were for udder infections.

The study found that antibiotic use on Danish dairy farms was low by international standards but significant differences in antibiotic use between farms was found for both types of farming systems, suggesting that further reductions in use were possible.

Despite the relatively low use in Danish dairy farming, use in the non-organic dairy cows was 2.8 to 3.4 times higher than in organic dairy cows. On the other hand use in the calves was only 20% higher on the non-organic farms compared with the organic farms.

The authors of the study suggested that non-organic farming could learn from organic farming, saying: "The significantly lower level of antibiotic use for cows in organic dairy herds could imply that restrictions on antibiotic usage could be used as a tool for reducing antibiotic use in other production systems."

# 5. INTERVIEWS OF SOIL ASSOCIATION PRODUCERS ON THEIR ATTITUDES TO ANTIBIOTIC USE

The Soil Association antibiotic data-collection project detailed in Chapter 3 found that Soil Association livestock producers have particularly low levels of use compared with national non-organic averages.

However, within this dataset there was considerable variation which could not be attributed to farm size. The Soil Association and the Alliance to Save Our Antibiotics decided to conduct telephone interviews with producers who were at the top and the bottom end of the antibiotic-use range to see if attitude and knowledge of the owner or stock keeper with regard to medicines or aspects of stockmanship or husbandry explained the variation.

The interviews were carried out by The George Farm Vets practice in September and October 2020 and a report summarising the findings was published [50].

The smallest producers were excluded but a wide range in producer size was still retained in the farms chosen for interview, with dairy farms ranging from 35 to 900 cows, beef farms which sold or slaughtered between 20 and 329 animals in the year and sheep farms ranging from 64 to 2166 breeding ewes. Two commercial-sized pig farms were interviewed with 250 and 350 sows respectively. Poultry farmers were not interviewed as all but one in the Soil Association survey had zero use.

Since the farmers being interviewed had all provided data on their antibiotic use, their responses may not be fully representative of all British organic farmers, but they nevertheless provide some helpful detail and some key themes emerged.

## IMPORTANCE OF VETERINARIANS ADVICE

All farmers interviewed were happy with their vets who were overwhelmingly the most commonly cited and trusted source for information and advice around medicines use. Across all sectors farmers liked to learn about medicines directly from their vet.

The one-to-one relationship with a trusted veterinary adviser was deemed very important by high and low users, and some sheep and beef farmers felt this was something they missed out on compared with dairy farms.

Low users in particular needed to work with a vet who they believed shared their views on livestock management and medicines use. All farmers interviewed felt than there was at least one such person working for their local practice although a repeated comment was that younger vets embraced better the need for reduced antibiotic use.

Some of these findings regarding the key roles that veterinarians can play in achieving responsible antibiotic use agree with previous studies of non-organic farmers [51,52,53].

## METHODS USED TO MINIMISE DISEASE AND ANTIBIOTIC USE

Across all sectors, cleanliness was considered most important husbandry factor for maintaining good animal health and low antibiotic use. Many considered the best way to achieve this was to minimise the housed period and to move livestock as frequently as possible to fresh ground.

Other key husbandry factors mentioned included:

- A low stocking rate
- Good stockmanship
- Good nutrition
- A low-stress environment
- Breeding specifically for health traits more than production
- Later weaning of piglets and avoiding mixing of groups
- Improving cow tracks to avoid foot problems
- Culling of repeatedly lame cows or those with a history of multiple treatments
- Investment in housing.

Dairy farmers used more alternative treatments to antibiotics than beef and sheep farmers. Many dairy farmers used anti-inflammatory or pain-relief medication, as did both the pig farmers. For mastitis, massage with liniment was a common first-line treatment among both high and low users. Vaccination, trace elements, homeopathy and disinfection of high-traffic areas were also used by farmers in the different sectors.

**COULD SOIL ASSOCIATION PRODUCERS REDUCE THEIR ANTIBIOTIC USE EVEN FURTHER?**

All farmers felt that they were very low users of antibiotics, irrespective of whether the benchmarking data showed they were high or low users in the period reviewed. This was an interesting and unexpected finding, as all had received a copy of the results of the benchmarking study with their position in the range identified. Few thought they could significantly reduce their usage further, except through the husbandry practices described above.

A survey of non-organic beef and sheep farmers also found that most thought that their use was below average and did not need to be reduced further [54].

However, it was noticeable that some Soil Association high users had already taken multiple actions since the review period (which ended in May 2019) and reduced usage significantly. Examples were sheep farms which implemented a tighter culling policy which had a big impact on lameness and beef herds where outwintering or a minimal housed period had dramatically reduced pneumonia incidence.

Particularly interesting were cases of dairy farmers that had moved to a "produced without antibiotics" (PWAB) system. In some countries, such as the US, in order to be certified as organic meat, dairy and eggs must be produced without any antibiotic use. So some milk contracts for Omsco, the UK's largest organic dairy cooperative, are now PWAB so that the milk qualifies for export to those countries.

Farmers who had been supplying milk on a PWAB contract for some time felt confident that reducing antibiotic use to almost nil had not had a detrimental impact on disease rates or welfare. All stated that antibiotics were used when necessary for welfare, but this was limited to cases of foot foul which had not responded to topical treatment or for the occasional caesarean section or difficult calving. Those who had recently converted to a PWAB contract, including one who had been a high user, were surprised not to encounter more problems, citing culling of cows with a history of multiple treatments and a reduction of stocking rate as important to them. The experience of those farms undergoing a conversion to a PWAB contract in learning to deal with mastitis without antibiotics is potentially very beneficial to those who are not on such a strict contract but who wish to reduce their use of antibiotics in this area.

These experiences suggest that, for several sectors, there is still room for reducing antibiotic use in organic farming, and even more so in non-organic farming.

# CONCLUSION

On 28 January 2022 the EU will ban all routine farm antibiotic use, including all preventative group treatments [13]. This is a major step forward for the regulation of antibiotics in Europe, far more important than the more symbolic ban on antibiotic growth promoters in 2006, and it will mean that a key organic standard on antibiotic use will now apply to all EU livestock farming.

Unfortunately, when the UK was still in the EU the government argued against ending all preventative group treatments with antibiotics [55], and now that the UK has left the EU the government has not committed to implementing the ban. Nevertheless, the British farming industry has taken voluntary action to reduce, or in the case of the poultry industry, to end preventative group treatments. These moves are already having an effect on farm antibiotic use which has fallen significantly in both the UK and the EU [6,56].

However, the data presented in this report shows that much lower levels of use are being achieved in organic farming. This suggests that focusing only on antibiotics policies and regulations, with insufficient attention being given to husbandry factors contributing to disease, will not deliver the very low levels of antibiotic use that are needed.

In Denmark, preventative group treatments with antibiotics are already illegal, and this partly explains why antibiotic use in Danish pigs is at less than half the UK level. However, data in Chapter 3 shows that this is still about 10 times higher than usage in Danish organic pigs. Most antibiotic use in the Danish pig industry is still linked to diseases caused by intensive-farming practices.

The new data on antibiotic usage from the convenience survey of Soil Association producers also shows that the organic approach is achieving very low levels of antibiotic use in the UK. In interviews many of these farmers said that they thought that husbandry and welfare factors such as keeping animals outdoors as much as possible, rotating pasture, low stocking rates, low levels of stress, breeding for health traits instead of just productivity, good nutrition and late weaning of piglets, were contributing to good animal health and the avoidance of medication.

These results demonstrate that an organic approach represents an existing framework for low usage and a potential resource for sharing best practice for very low antibiotic use more widely. If this can catch the interest of vets, particularly those coming into the industry, then it improves the chances of farmers and vets with an interest in low antibiotic use developing mutually beneficial relationships.

The government should provide financial support for organic farming and other whole-farm systems which achieve high levels of animal health and welfare and low levels of antibiotic use. Defra's Environment Land Management Scheme (ELMS) and Animal Health and Welfare Pathway will be based on the principle of "public money for public goods", but recognition and financial support should be given to organic farming which has high levels of animal health and welfare and, by achieving particularly low levels of antibiotic use through good husbandry, helps reduce the spread of antibiotic resistance.

Regulators also need to be looking more closely at what is already being achieved in organic farming, and in some other higher-welfare systems, to determine what practices or systems need to be altered or ended in intensive farming in order to improve animal health. As the EMA and EFSA said in a 2017 report on how to reduce farm antibiotic use, "Farming systems with heavy antimicrobial use should be critically reviewed, to determine whether/how such systems could sustainably reduce the use of on-farm antimicrobials. If a sustainable reduction in the use of on-farm antimicrobials is not achievable, these systems should ideally be phased out" [31].

In contrast, a 2016 report by the European Parliamentary Research Service said that "Today organic animal husbandry essentially fulfils the demands for the restrictive use of antibiotics made by WHO and the European Parliament to counteract the development and spread of antibiotic resistance. Knowledge dissemination between conventional and organic production may be important steps in the right direction" [57].

The data in this report confirms that many organic producers are achieving very low levels of antibiotic use, but it also shows that there is still room for further reductions in use by some higher organic users. The Soil Association has now altered its annual data collection process to include request of antibiotic usage. This may help further increase awareness of the importance of limiting antibiotic use to cases of real necessity and could be an important factor in achieving even lower levels of antibiotic use in years to come.



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The Alliance to Save Our Antibiotics is an alliance of health, medical, civil society and animal welfare groups campaigning to stop the overuse of antibiotics in animal farming. It was founded by Compassion in World Farming, the Soil Association and Sustain in 2009. Our vision is a world in which human and animal health and well-being are protected by food and farming systems that do not rely on routine antibiotic use.

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