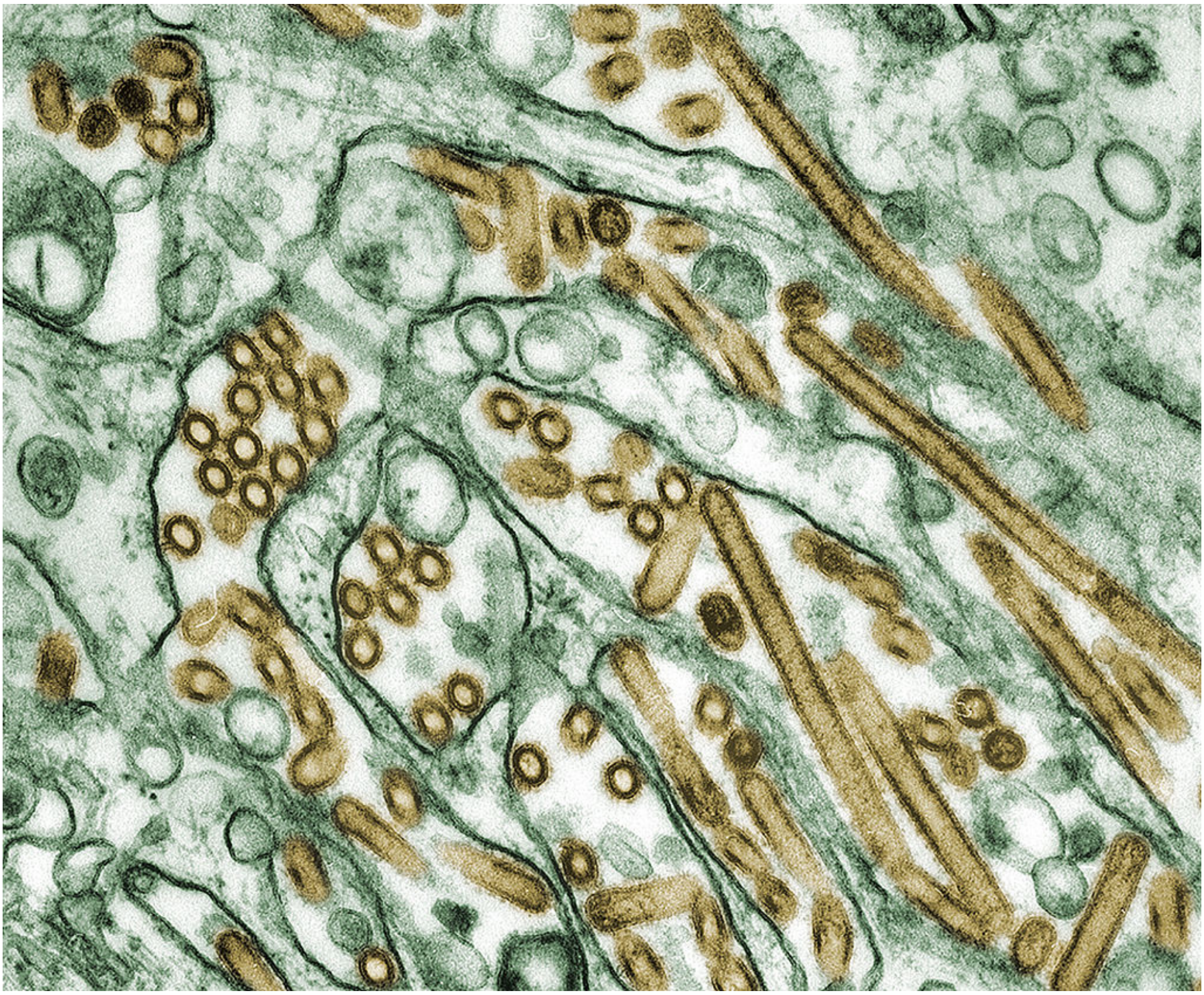
Europe – Disease Outbreak Report Summary, 6-12 November 2025



Reporting Period: November 6-12, 2025

Extracted Data by Disease Category

1. ASF in Domestic Pigs

Country	Number of Outbreaks	
Romania	15	
Moldova	1	
TOTAL	**16**	

2. ASF in Wild Boar

Country	Number of Outbreaks	
Bulgaria	32	
Germany	25	
Estonia	8	
Croatia	14	
Hungary	8	
Italy	7	
Latvia	21	
Lithuania	4	
Poland	4	
Romania	12	
North Macedonia	1	
TOTAL	**136**	

3. HPAI (NON-P) in Captive Birds / H5N1

Country	Number of Outbreaks	
Bulgaria	1	
Czech Republic	2	
Germany	4	
France	3	
Netherlands	1	
TOTAL	**11**	

4. HPAI (NON-P) in Wild Birds / H5 (N untyped)

Country	Number of Outbreaks	
Norway	1	
TOTAL	**1**	

5. HPAI (NON-P) in Wild Birds / H5N1

Country	Number of Outbreaks	
Austria	8	
Belgium	4	
Germany	462	
Denmark	15	
Spain	16	
Finland	3	

Country	Number of Outbreaks	
France	25	
Ireland	1	
Italy	1	
Lithuania	1	
Luxembourg	8	
Latvia	3	
Netherlands	22	
Poland	2	
Slovakia	1	
Slovenia	2	
Sweden	5	
Switzerland	1	
Norway	1	
Ukraine	1	
TOTAL	**581**	

6. High Pathogenicity Avian Influenza Viruses (Poultry) (Inf. with) / H5N1

Country	Number of Outbreaks	
Bulgaria	1	
Czech Republic	3	
Germany	26	
France	7	
Hungary	1	
Ireland	1	
Italy	2	
Netherlands	3	
Poland	3	
Sweden	2	
United Kingdom (Northern Ireland)	2	
TOTAL	**51**	

Summary Statistics

Disease Category	Total Outbreaks
ASF in Domestic Pigs	16

Disease Category	Total Outbreaks
ASF in Wild Boar	136
HPAI(NON-P) in Captive Birds / H5N1	11
HPAI(NON-P) in Wild Birds / H5 (N untyped)	1
HPAI(NON-P) in Wild Birds / H5N1	581
High Pathogenicity Avian Influenza Viruses (Poultry) / H5N1	51

HPAI (NON-P) – High Pathogenicity Avian Influenza in Non-Poultry

This designation refers to HPAI infections occurring in birds that are NOT commercial poultry:

Captive Birds:

- Birds kept in zoos, aviaries, wildlife centers, or as pets
- Examples from report: Indian Peafowl, Muscovy Duck
- These are non-commercial birds under human care

Wild Birds:

- Free-living birds in natural habitats
- Examples from report: Mallard, Mute Swan, Common Crane, Grey Heron, Greylag Goose, Herring Gull, Eurasian buzzard, Whooper Swan, Common pheasant

Subtype Nomenclature

H5N1:

- **H5** = Hemagglutinin protein type 5
- **N1** = Neuraminidase protein type 1
- Full virus identification with both surface proteins characterized
- The most prevalent highly pathogenic strain globally

H5 (N untyped):

- Only hemagglutinin type identified (H5)
- Neuraminidase type not yet determined through laboratory testing
- Preliminary identification pending complete characterization

HPAI in Poultry (Inf. with):

Refers to infections in commercial poultry operations:

- Chickens, turkeys, ducks, geese raised for meat or eggs
- High impact on food security and international trade
- Triggers specific control measures including culling

Why These Classifications Matter:

1. **Epidemiological Tracking:** Wild birds serve as natural reservoirs and spread virus through migration routes

2. **Risk Assessment:** Different species require different control strategies
3. **Trade Implications:** HPAI in commercial poultry directly affects international trade regulations
4. **Public Health Monitoring:** Tracking which strains affect which species helps assess zoonotic (animal-to-human) transmission risk
5. **Control Measures:**
    - Commercial poultry can be culled and vaccinated
    - Wild birds require surveillance and monitoring
    - Captive birds need biosecurity measures

Geographic Distribution Highlights

ASF:

- Wild boar outbreaks (136) vastly outnumber domestic pig outbreaks (16)
- Germany had the most wild boar cases (25), Romania had most domestic pig cases (15)
- Concentrated in Eastern and Central Europe

HPAI:

- Germany dominated with 462 wild bird outbreaks and 26 poultry outbreaks
- Wild bird outbreaks (581) significantly exceeded poultry outbreaks (51)
- Widespread across Europe, indicating active transmission

Data Source: ADIS (Animal Disease Information System) Weekly Notification **Created:** November 14, 2025

Header image photo credit: Cynthia Goldsmith Content Providers: CDC/ Courtesy of Cynthia Goldsmith; Jacqueline Katz; Sherif R. Zaki
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The ongoing battle with food poisoning: A pressing public health concern

By Dr. Inge Heinzl

Globally, unsafe food leads to 600 million cases of foodborne illnesses each year, resulting in 420,000 deaths, with 40% of these deaths occurring among children under 5 years of age. Especially for immunocompromised elderly and children, the pathogens can be dangerous.

In 2019, 27 European Union (EU) member states reported a total of 5,175 foodborne outbreaks, leading to 49,463 cases of illness, 3,859 hospitalizations, and 60 deaths. This year, e.g., salmonella-contaminated arugula from Italy caused 98 cases in Germany, 16 in Austria, and 23 in Denmark (Whitworth, 2024).

In the United States, the E. coli outbreak recently reported by 13 states and linked to McDonald's is just one of the foodborne disease incidents this year. Several salmonella infections have also spread nationwide, with pathogens detected in various foods, including eggs, cucumbers, fresh basil, and charcuterie meats (CDC, 2024 LINK).

Symptoms of foodborne diseases may vary

The most common symptoms of food poisoning include stomach pain or cramps together with diarrhea and vomiting, nausea, and probably fever. In severe cases, diarrhea can get bloody and/or last more than 3 days. Fever (temperature over 38°C within the body) can occur, and vomiting can get so severe that the sick person cannot keep liquids inside and suffers from dehydration.

E. coli contamination, particularly from pathogenic strains like E. coli O157:H7, can pose serious health risks to consumers. It has been associated with symptoms ranging from mild gastrointestinal distress to severe conditions like hemolytic uremic syndrome (HUS), which can lead to kidney failure.

Possible sources of contamination

Usually, food is not sterile. It contains beneficial microorganisms such as lactic acid bacteria or cultured molds, but also unwanted ones such as E. coli or salmonella. The crucial point is the proliferation of the harmful ones. Food poisoning is often the result of poor hygiene or wrong processing. Here are some possible causes of getting a foodborne disease.

1. **Undercooked meat products or eggs:** Undercooked meat and eggs are primary sources of, e.g., E. coli or salmonella. If these foodstuffs are not cooked to a high enough internal temperature (meat: 70 – 80°C for at least 10 min.), the bacteria can survive and pose risks to consumers. High-speed cooking processes, standard in fast-food restaurants, can lead to unevenly cooked food, increasing the risk of contamination. However, the more probable origins of food poisoning are
2. **Raw vegetables and fresh produce:** Leafy greens and other raw vegetables are increasingly associated with E. coli outbreaks. Contamination often occurs during harvesting, processing, or transportation. When vegetables are served raw, such as in salads, the pathogens present might not be eliminated, which can lead to consumer exposure.
3. **Cross-contamination in preparation areas:** E. coli can spread easily in food preparation areas if strict separation between raw and cooked foods is not maintained. For example, if raw beef juices come into contact with salad ingredients or utensils, the risk of cross-contamination increases significantly.
4. **Cross-contamination in the slaughterhouse:** If infected animals are slaughtered together with healthy animals, the meat of the healthy ones can be contaminated with the juices of the ill ones.
5. **Inadequate supplier protocols and traceability:** The complex supply chains used by fast-food companies often involve multiple suppliers across various locations. A lack of strict hygiene and safety practices among suppliers can introduce contaminated food into the restaurant chain's supply, leading to potential outbreaks.

Countermeasures to protect consumers

To prevent future E. coli outbreaks, implementing a range of countermeasures in food-providing businesses such as restaurants, fast-food chains, and suppliers, focusing on safe food handling, better biosecurity, and improved oversight throughout the supply chain, is vital. Food safety is broader than that, however. It has a critical role in ensuring that food stays safe at every stage of the food chain – from production to harvest, processing, storage, distribution, all the way to preparation and consumption.

1. **Enhanced Cooking Standards and Temperature Monitoring:** Ensuring meat is cooked to a safe internal temperature is crucial.
2. **Routine Microbial Testing of High-Risk Foods:** Routine microbial testing, particularly of high-risk items like ground beef and fresh produce, can detect E. coli contamination before the food reaches consumers. Testing can be carried out at the supplier level and within restaurants. In cases where contamination is detected, affected products can be removed from circulation promptly, minimizing the risk to customers.
3. **Separation of Raw and Cooked Food Handling Areas:** Cross-contamination can be reduced by establishing dedicated areas and utensils for handling raw and cooked foods. For instance, separate workspaces for salad preparation and burger assembly can prevent contact between potentially contaminated raw ingredients and ready-to-eat items. Staff training on the importance of these practices is essential to their successful implementation.
4. **Supplier Standards and Transparent Audits:** Supplier chains must ensure that suppliers adhere to strict food safety protocols, including regular sanitation and testing practices. Supplier audits conducted by independent third parties can help verify compliance and identify any gaps in food safety practices. Transparency in these audits can also build consumer trust, as customers are more likely to feel reassured when they know safety checks are in place.
5. **Implementation of High-Pressure Processing (HPP):** High-pressure processing (HPP) effectively reduces bacterial contamination in foods without using heat, which can be particularly beneficial for items like fresh produce that are often served raw. HPP uses high levels of pressure to kill pathogens, including E. coli. However, as HPP provokes changes in the

structure of vegetable cell walls, it is unsuitable for salads and other leafy greens.

6. **Enhanced Employee Training on Hygiene Practices:** Proper hygiene practices are fundamental in preventing contamination. Employees must wash their hands frequently, especially after handling raw foods. Fast-food chains should provide thorough training on proper food safety protocols, including how to handle food items safely and maintain a clean working environment.
7. **Crisis Response Protocols and Traceability Systems:** In the event of an outbreak, rapid response is critical. Fast-food companies should have crisis protocols in place that include steps for immediate product recalls, customer notifications, and investigation procedures. Improved traceability systems can also allow companies to track the source of contamination quickly, limiting the spread and reducing the impact on consumers.
8. **Preventing infections with harmful enteropathogens already in the animal:** To get “clean” animals arriving at the slaughterhouse, already the farmer must aspire to prevent/treat infections of the animals with pathogens possibly provoking foodborne diseases. For this purpose, the farmer can resort to vaccines and feed supplements supporting gut health, both for prevention and on medicine such as antibiotics when treatment is needed.

A path forward: Strengthening food safety standards

This new E. coli outbreak in the fast-food industry highlights the ongoing challenges of maintaining food safety standards at all food preparation and distribution stages. By implementing stricter cooking standards, enhancing biosecurity measures, enforcing supplier compliance, and improving traceability, fast-food chains like McDonald’s can significantly reduce the risk of E. coli contamination. Ultimately, consumer protection depends on a multifaceted approach that integrates strong hygiene practices, supplier oversight, and advanced technology in food safety. Through these measures, companies can work to restore consumer confidence, minimize health risks, and set a standard for food safety across the industry.

INFOGRAPHIC – Target measurements for water quality

Water is a main nutrient and carrier for vaccines, medicine – including antibiotics, but also for pathogens

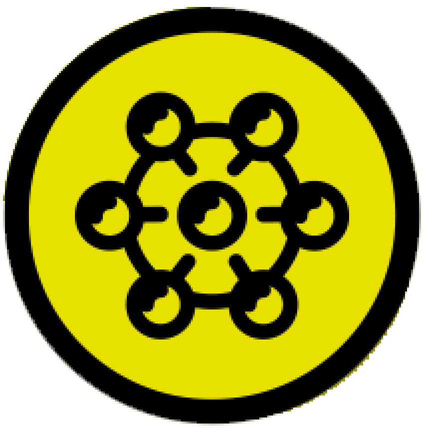
Chemistry

pH and pKa

Acidity and dissociation index
Target: pH 3,5-3,8 Important for acids application (E.g. organic acids, etc), and ORP

Hardness

Content of Ca, sometimes plus Mg
Target: better TDS Important for acid binding capacity (ABC, buffer capacity)



Oxidation Reduction Potential (ORP)

Target: 650 mV>700 mV » reduces water intake Important for biocides application (E.g. chlorination)

Total Dissolved Solids (TDS)

Sum of dissolved salts, minerals, metals, carbonates, organics Target: 2000 ppm>3000 ppm » laxation Important for buffer capacity and ORP

Microbiology

Yeast

Target: < 5000 cfu/gr

Enterobacterias

Target: < 100 cfu/gr

Moulds

Target: < 100 cfu/gr

Toxin Mitigation 101: Essentials for Animal Production

*By **Monish Raj**, Assistant Manager-Technical Services, EW Nutrition*
***Inge Heinzl**, Editor, EW Nutrition*

Mycotoxins, toxic secondary metabolites produced by fungi, are a constant and severe threat to animal production. They can contaminate grains used for animal feed and are highly stable, invisible, and resistant to high temperatures and normal feed manufacturing processes. Mycotoxin-producing fungi can be found during plant growth and in stored grains; the prevalence of fungi species depends on environmental conditions, though in grains, we find mainly three genera: Aspergillus, Penicillium, and Fusarium. The most critical mycotoxins for poultry production and the fungi that produce them are detailed in Fig 1.

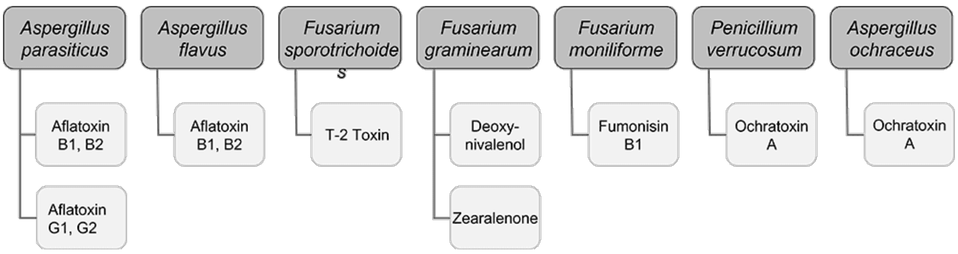


Figure 1: Fungi species and their mycotoxins of worldwide importance for poultry production (adapted from Bryden, 2012).

The effects of mycotoxins on the animal are manifold

When, usually, more than one mycotoxin enters the animal, they “cooperate” with each other, which means that they combine their effects in different ways. Also, not all mycotoxins have the same targets.

The synergistic effect: When 1+1 ≥3

Even at low concentrations, mycotoxins can display synergistic effects, which means that the toxicological consequences of two or more mycotoxins present in the same sample will be higher than the sum of the toxicological effects of the individual mycotoxins. So, disregarded mycotoxins can suddenly get important due to their additive or synergistic effect.

Table 1: Synergistic effects of mycotoxins in poultry

Synergistic interactions				
	DON	ZEN	T-2	DAS
FUM	*	*	*	
NIV	*	*	*	
AFL			*	*

Table 2: Additive effects of mycotoxins in poultry

Additive interactions				
	AFL	T2	DAS	MON
FUM	+	+	+	+
DON	+	+		
OTA	+	+		

Recognize the effects of mycotoxins in animals is not easy

The mode of action of mycotoxins in animals is complex and has many implications. Research so far could identify the main target organs and effects of high levels of individual mycotoxins. However, the impact of low contamination levels and interactions are not entirely understood, as they are subtle, and their identification requires diverse analytical methods and closer observation.

With regard to the gastrointestinal tract, mycotoxins can inhibit the absorption of nutrients vital for maintaining health, growth, productivity, and reproduction. The nutrients affected include amino acids, lipid-soluble vitamins (vitamins A, D, E, and K), and minerals, especially Ca and P (Devegowda and Murthy, 2005). As a result of improper absorption of nutrients, egg production, eggshell formation, fertility, and hatchability are also negatively influenced.

Most mycotoxins also have a negative impact on the immune system, causing a higher susceptibility to disease and compromising the success of vaccinations. Besides that, organs like kidneys, the liver, and lungs, but also reproduction, endocrine, and nervous systems get battered.

Mycotoxins have specific targets

Aflatoxins, fumonisins, and ochratoxin impair the liver and thus the physiological processes modulated and performed by it:

- lipid and carbohydrate metabolism and storage
- synthesis of functional proteins such as hormones, enzymes, and nutrient transporters
- metabolism of proteins, vitamins, and minerals.

For trichothecenes, the gastrointestinal tract is the main target. There, they hamper digestion, absorption, and intestinal integrity. T-2 can even produce necrosis in the oral cavity and esophagus.

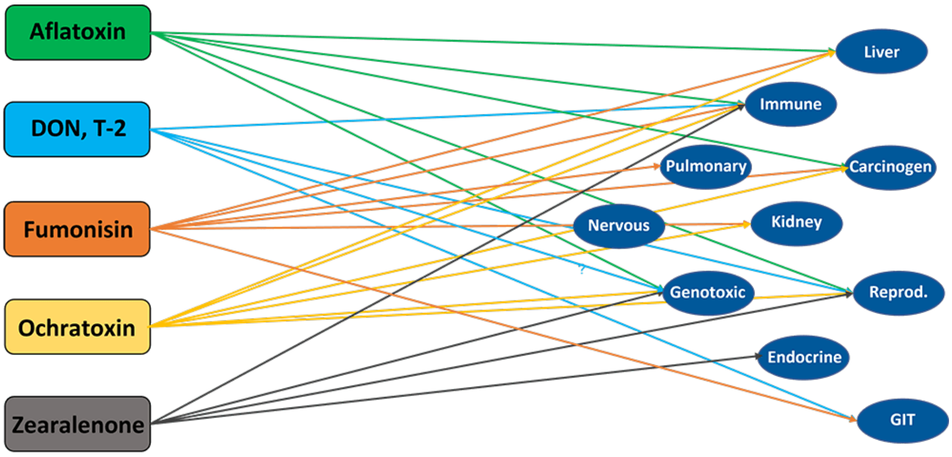


Figure 2: Main target organs of important mycotoxins

How to reduce mycotoxicosis?

There are two main paths of action, depending on whether you are placed along the crop production, feed production, or animal production cycle. Essentially, you can either prevent the formation of mycotoxins on the plant on the field during harvest and storage or, if placed at a further point along the chain, mitigate their impact.

Preventing mycotoxin production means preventing mold growth

To minimize the production of mycotoxins, the development of molds must be inhibited already during the cultivation of the plants and later on throughout storage. For this purpose, different measures can be taken:

Selection of the suitable crop variety, good practices, and optimal harvesting conditions are half of the battle

Already before and during the production of the grains, actions can be taken to minimize mold growth as far as possible:

- Choose varieties of grain that are area-specific and resistant to insects and fungal attacks.
- Practice crop rotation
- Harvest proper and timely
- Avoid damage to kernels by maintaining the proper condition of harvesting equipment.

Optimal moisture of the grains and the best hygienic conditions are essential

The next step is storage. Here too, try to provide the best conditions.

- Dry properly: grains should be stored at <13% of moisture
- Control moisture: minimize chances of moisture to increase due to condensation, and rain-water leakage
- Biosecurity: clean the bins and silos routinely.
- Prevent mold growth: organic acids can help prevent mold growth and increase storage life.

Mold production does not mean that the war is lost

Even if molds and, therefore, mycotoxins occur, there is still the possibility to change tack with several actions. There are measures to improve feed and support the animal when it has already ingested the contaminated feed.

1. Feed can sometimes be decontaminated

If a high level of mycotoxin contamination is detected, removing, replacing, or diluting contaminated raw materials is possible. However, this is not very practical, economically costly, and not always very effective, as many molds cannot be seen. Also, heat treatment does not have the desired effect, as mycotoxins are highly heat stable.

2. Effects of mycotoxins can be mitigated

Even when mycotoxins are already present in raw materials or finished feed, you still can act. Adding products adsorbing the mycotoxins or mitigating the effects of mycotoxins in the organism has been considered a highly-effective measure to protect the animals (Galvano et al., 2001).

This type of mycotoxin mitigation happens at the animal production stage and consists of suppressing or reducing the absorption of mycotoxins in the animal. Suppose the mycotoxins get absorbed in the animal to a certain degree. In that case, mycotoxin mitigation agents help by promoting the excretion of mycotoxins, modifying their mode of action, or reducing their effects. As toxin-mitigating agents, the following are very common:

Aluminosilicates: inorganic compounds widely found in nature that are the most common agents used to mitigate the impact of mycotoxins in animals. Their layered (phyllosilicates) or porous (tectosilicates) structure helps “trap” mycotoxins and adsorbs them.

- Bentonite / Montmorillonite: classified as phyllosilicate, originated from volcanic ash. This absorbent clay is known to bind multiple toxins in vivo. Incidentally, its name derives from the Benton Shale in the USA, where large formations were discovered 150 years ago. Bentonite mainly consists of smectite minerals, especially montmorillonite (a layered silicate with a larger surface area and laminar structure).

- Zeolites: porous crystalline tectosilicates, consisting of aluminum, oxygen, and silicon. They have a framework structure with channels that fit cations and small molecules. The name “zeolite” means “boiling stone” in Greek, alluding to the steam this type of mineral can give off in the heat). The large pores of this material help to trap toxins.

Activated charcoal: the charcoal is “activated” when heated at very high temperatures together with gas. Afterward, it is submitted to chemical processes to remove impurities and expand the surface area. This porous, powdered, non-soluble organic compound is sometimes used as a binder, including in cases of treating acute poisoning with certain substances.

Yeast cell wall: derived from *Saccharomyces cerevisiae.* Yeast cell walls are widely used as adsorbing agents. Esterified glucomannan polymer extracted from the yeast cell wall was shown to bind to aflatoxin, ochratoxin, and T-2 toxin, individually and combined (Raju and Devegowda 2000).

Bacteria: In some studies, Lactic Acid Bacteria (LAB), particularly *Lactobacillus rhamnosus*, were found to have the ability to reduce mycotoxin contamination.

Which characteristics are crucial for an effective toxin-mitigating solution

If you are looking for an effective solution to mitigate the adverse effects of mycotoxins, you should keep some essential requirements:

1. The product must be safe to use:
    a. safe for the feed-mill workers.
    b. does not have any adverse effect on the animal
    c. does not leave residues in the animal
    d. does not bind with nutrients in the feed.
2. It must show the following effects:
    a. effectively adsorbs the toxins relevant to your operation.
    b. helps the animals to cope with the consequences of non-bound toxins.
3. It must be practical to use:
    a. cost-effective
    b. easy to store and add to the feed.

Depending on

- the challenge (one mycotoxin or several, aflatoxin or another mycotoxin),
- the animals (short-cycle or long-living animals), and
- the economical resources that can be invested,

different solutions are available on the market. The more cost-effective solutions mainly contain clay to adsorb the toxins. Higher-in-price products often additionally contain substances such as phytogenics supporting the animal to cope with the consequences of non-bound mycotoxins.

Solis – the cost-effective solution

In the case of contamination with only aflatoxin, the cost-effective solution Solis is recommended. Solis consists of well-selected superior silicates with high surface area due to its layered structure. Solis shows high adsorption of aflatoxin B1, which was proven in a trial:

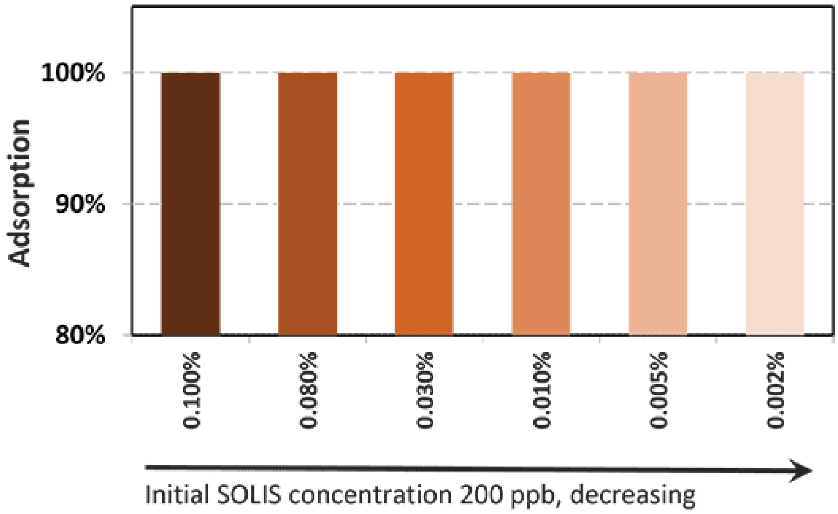


Figure 3: Binding capacity of Solis for Aflatoxin

Even at a low inclusion rate, Solis effectively binds the tested mycotoxin at a very high rate of nearly 100%. It is a high-efficient, cost-effective solution for aflatoxin contamination.

Solis Max 2.0: The effective mycotoxin solution for sustainable profitability

Solis Max 2.0 has a synergistic combination of ingredients that acts by chemi- and physisorption to prevent toxic fungal metabolites from damaging the animal’s gastrointestinal tract and entering the bloodstream.

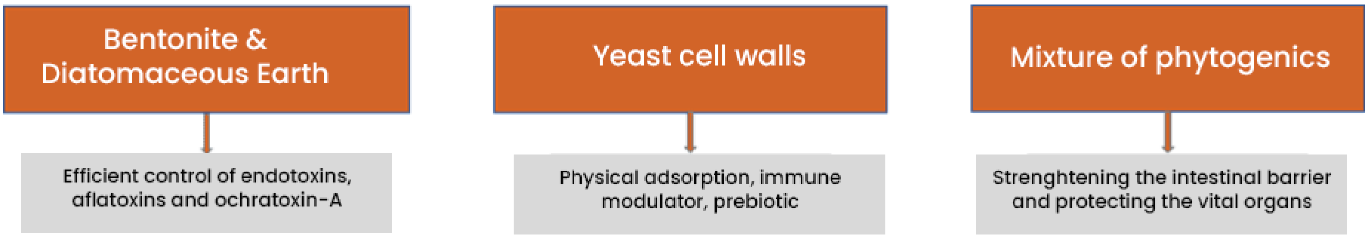


Figure 4: Composition and effects of Solis Max 2.0

Solis Max 2.0 is suitable for more complex challenges and longer-living animals: in addition to the pure mycotoxin adsorption, Solis Max 2.0 also effectively supports the liver and, thus, the animal in its fight against mycotoxins.

In an in vitro trial, the adsorption capacity of Solis Max 2.0 for the most relevant mycotoxins was tested. For the test, the concentrations of Solis Max 2.0 in the test solutions equated to 1kg/t and 2kg/t of feed.

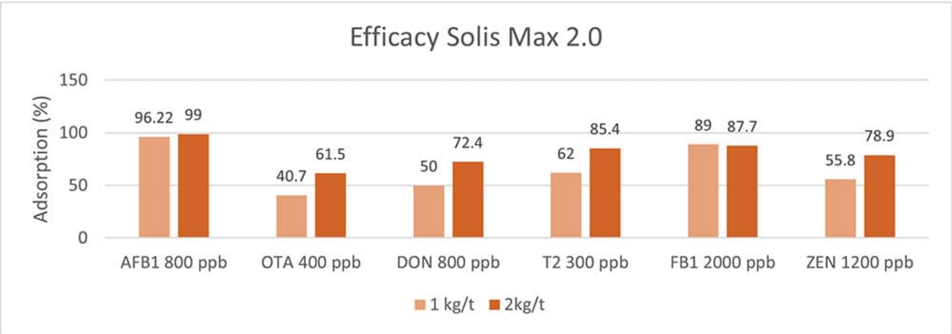


Figure 5: Efficacy of Solis Max 2.0 against different mycotoxins relevant in poultry production

The test showed a high adsorption capacity: between 80% and 90% for Aflatoxin B1, T-2 Toxin (2kg/t), and Fumonisin B1. For OTA, DON, and Zearalenone, adsorption rates between 40% and 80% could be achieved at both concentrations (Figure 5). This test demonstrated that Solis Max 2.0 could be considered a valuable tool to mitigate the effects of mycotoxins in poultry.

Broiler trial shows improved performance in broilers

Protected and, therefore, healthier animals can use their resources for growing/laying eggs. A trial showed improved liver health and performance in broilers challenged with two different mycotoxins but supported with Solis Max 2.0.

For the trial, 480 Ross-308 broilers were divided into three groups of 160 birds each. Each group was placed in 8 pens of 20 birds in a single house. Nutrition and management were the same for all groups. If the birds were challenged, they received feed contaminated with 30 ppb of Aflatoxin B1 (AFB1) and 500 ppb of Ochratoxin Alpha (OTA).

Negative control:	no challenge	no mycotoxin-mitigating product
Challenged group:	challenge	no mycotoxin-mitigating product
Challenge + Solis Max 2.0	challenge	Solis Max 2.0, 1kg/t

The body weight and FCR performance parameters were measured, as well as the blood parameters of alanine aminotransferase and aspartate aminotransferase, both related to liver damage when increased.

Concerning performance as well as liver health, the trial showed partly even better results for the challenged group fed with Solis Max 2.0 than for the negative, unchallenged control (Figures 6 and 7):

- 6% higher body weight than the negative control and 18.5% higher body weight than the challenged group
- 12 points and 49 points better FCR than the negative control and the challenged group, respectively
- Lower levels of AST and ALT compared to the challenged group, showing a better liver health

The values for body weight, FCR, and AST, even better than the negative control, may be owed to the content of different gut and liver health-supporting phytomolecules.

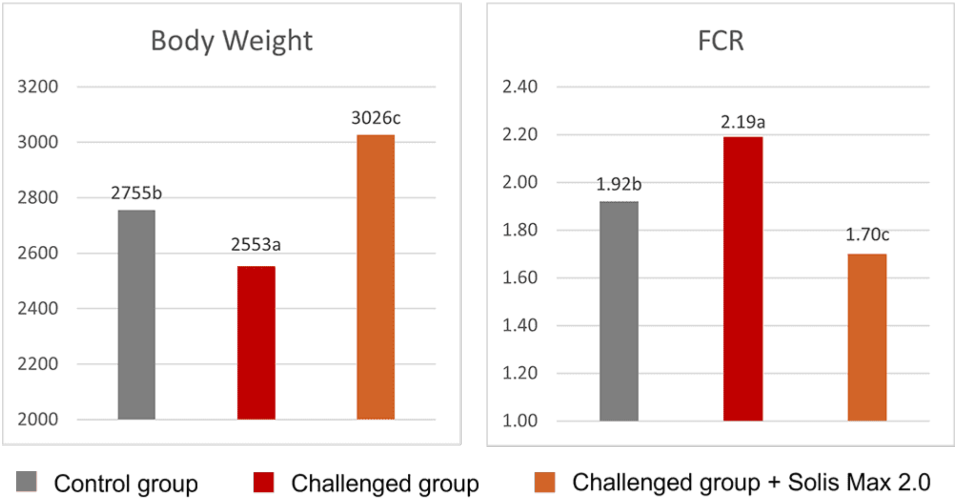


Figure 6: Better performance data due to the addition of Solis Max 2.0

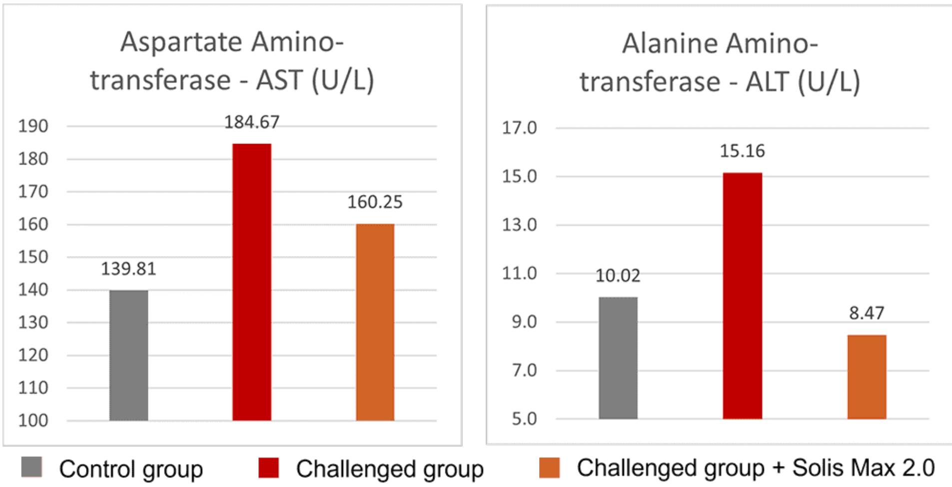


Figure 7: Healthier liver shown by lower values of AST and ALT

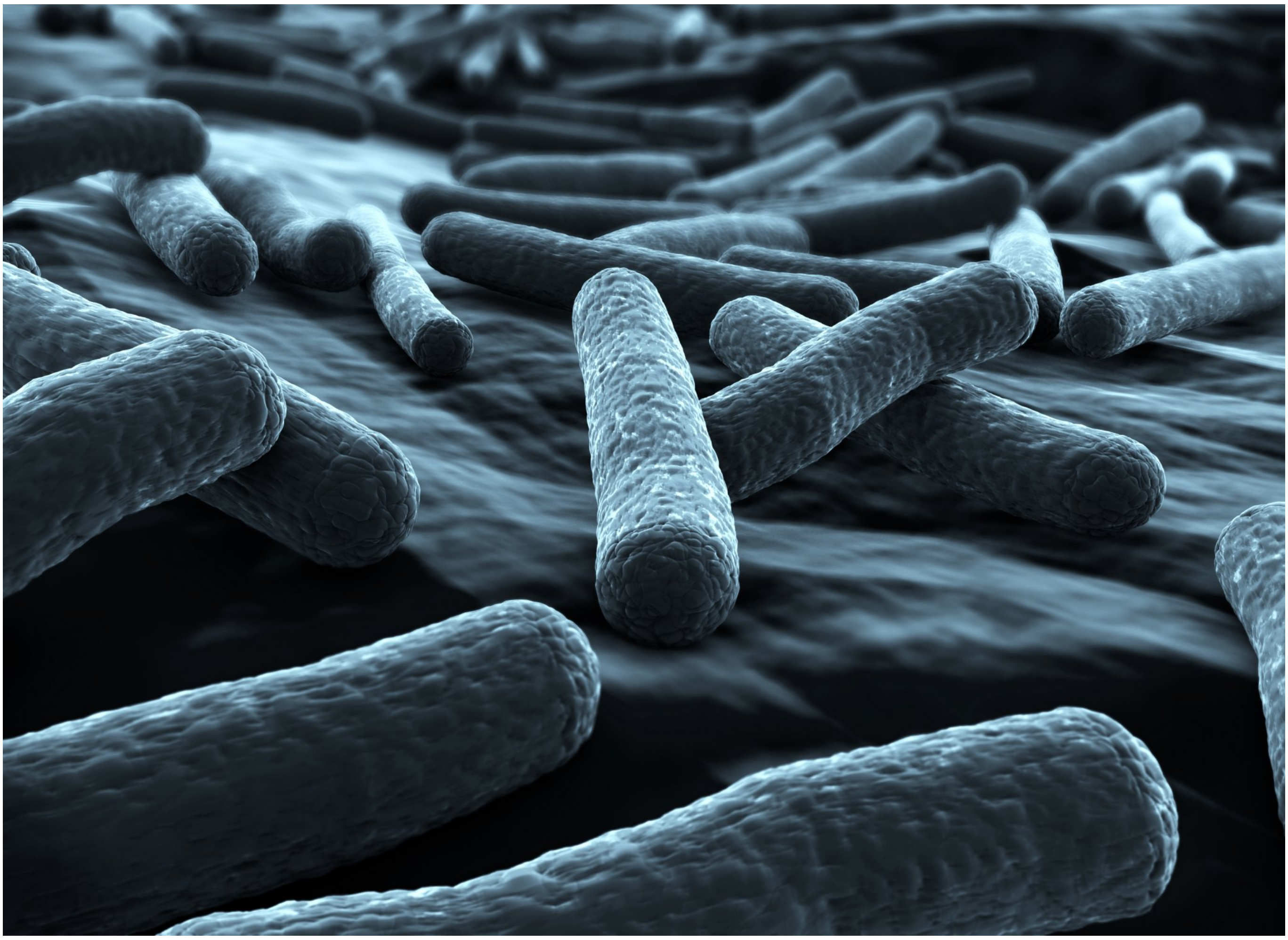
Effective toxin risk management: staying power is required

Mycotoxin mitigation requires many different approaches. Mycotoxin mitigation starts with sewing the appropriate plants and continues up to the post-ingestion moment. From various studies and field experience, we find that besides the right decisions about grain crops, storage management, and hygiene, the use of effective products which mitigate the adverse effects of mycotoxins is the most practical and effective way to maintain animals healthy and well-performing. According to Eskola and co-workers (2020), the worldwide contamination of crops with mycotoxins can be up to 80% due to the impact of climate change and the availability of sensitive technologies for analysis and detection. Using a proper mycotoxin mitigation program as a precautionary measure is, therefore, always recommended in animal production.

Toxin Risk Management

EW Nutrition's Toxin Risk Management Program supports farmers by offering a tool (MasterRisk) that helps identify and evaluate the risk and gives recommendations concerning using toxin solutions.

Antibiotic reduction: the key role of biosecurity



Biosecurity is the foundation for disease prevention. It includes all measures to reduce the risk of introduction and spread of infectious agents, using our knowledge of disease transmission processes.

Biosecurity is all the more important in antibiotic reduction scenarios: consistently high biosecurity standards can contribute substantially to the reduction of antimicrobial resistance, by preventing the introduction of resistance genes to the farm, and also by lowering the need for antimicrobials.

Higher biosecurity, lower use of antimicrobials

Laanen et al. (2013) studied the profile of swine farmers across Europe, finding a relation between a high level of internal biosecurity, an efficient control of infectious diseases, and a reduced need for antimicrobials.

In another study, Gelaude et al. (2014) examined Belgian broiler farms, concluding that antimicrobial use could be reduced by almost 30% when biosecurity and other farm issues were improved within a year. Collineau et at. (2017) studied swine farms in Belgium, France, Germany and Sweden. On average, antimicrobial use dropped by 47% – but farms with higher biosecurity compliance and a holistic approach (e.g. management and nutrition changes) needed even fewer antimicrobials.

Interventions pay off

Of course, the interventions necessary to achieve an increased level of biosecurity carry some costs. However, such interventions, especially if combined with better management of newborn animals and nutritional improvements, also strengthen productivity.

The same studies, which report that biosecurity improvements decrease antimicrobial use, also report stronger animal performance. For broilers, Laanen et al. (2013) found a reduction of 0.5 percentage points in mortality and one point in FCR. For pigs, Collineau et al. (2017) found an improvement during both the pre-weaning and the fattening period of 0.7 and 0.9 percentage points, respectively.

Execution is a challenge

Biosecurity is considered the cheapest and most effective intervention in antibiotic reduction programs, but compliance is often difficult to achieve and thus low. It sounds simple: stop the introduction and spread of diseases.

However, in practice, this involves adopting a new set of attitudes and behaviors across all animal production and care activities. Measures should not be constraints, but part of a holistic process to improve the health of animals and people, to reduce antibiotics and boost performance.

Best practices

If you want to design a biosecurity program or improve an existing one, consider these three factors:

1. **Know your menace**
   Identify and prioritize the disease agents of **greatest concern** to the facility, focusing on the processes that carry a risk of pathogen entrance and spread, and are frequently **repeated**. Additionally, consider the **size** of the facility – more animals means higher risk.

2. **Know your place**
   Define the *status quo*, ideally using external questionnaires or audits (e.g. BioCheck UGent). This helps you identify and **gaps** in your biosecurity plan. **Measures** need to be based on the principles of **separation** (between high and low-risk animals and areas) and **reduction** (lower the infection pressure).

3. **Know your processes**
   An exhaustive evaluation of the **daily farm practices** – e.g. the movement of personnel, equipment and visitors, and or used litter management – will help you find **weak spots** so you can eliminate, prevent, or minimize the **potential** of disease.

The bottom line

Biosecurity measures are the basis for disease prevention in any profitable animal production system. Preventing the entrance and spread of disease pays off through performance improvements and lower antimicrobial use. Taking this to the next level, where biosecurity compliance complements improvements in management, health, and nutrition, sets your production up for long-term success.

By Marisabel Caballero and Fellipe Freitas Barbosa

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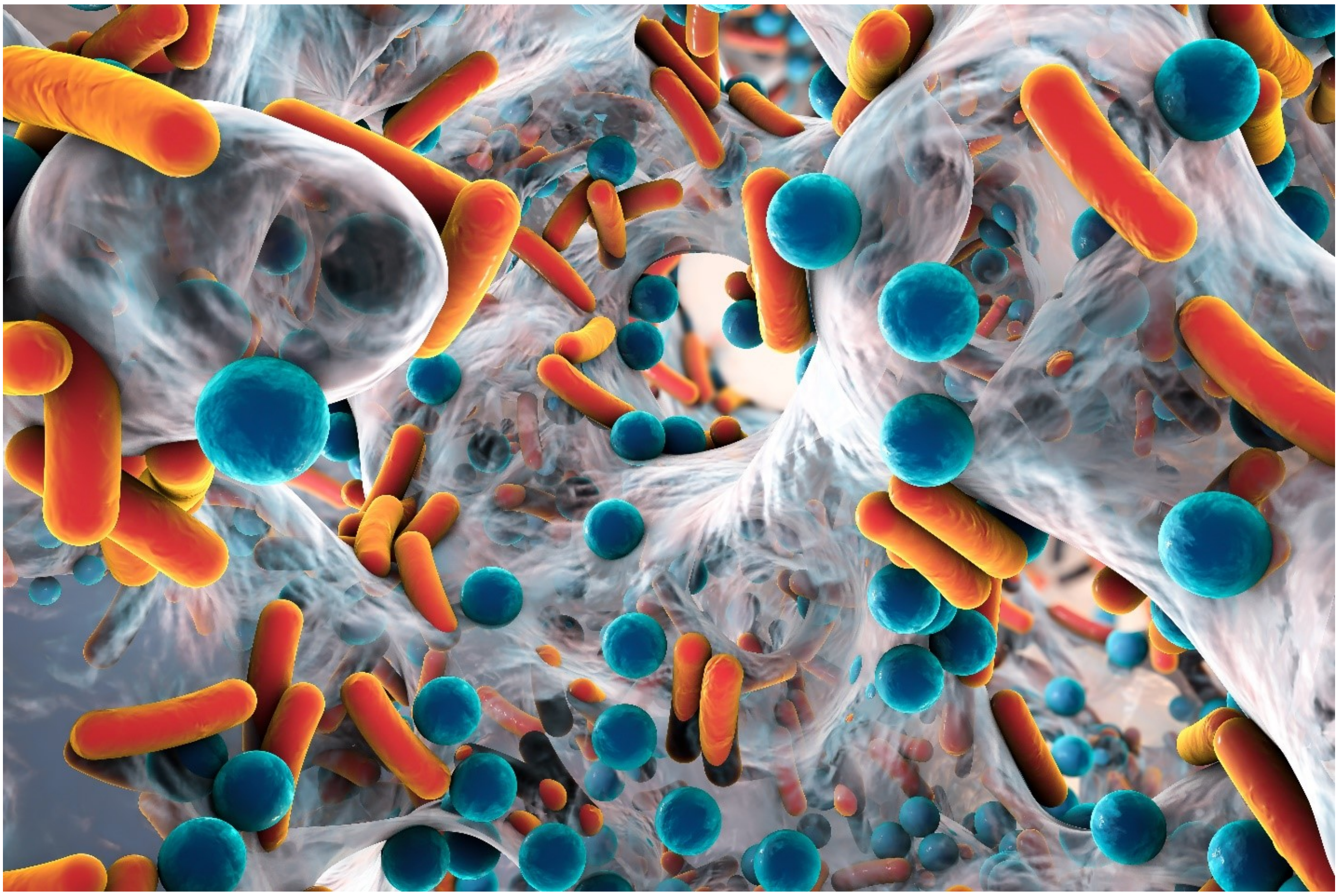
Want to reduce antibiotic use? Biosecurity and sanitation are crucial



By T.J. Gaydos

Biosecurity may not sound like an exciting topic at first, but it is a critical component of responsible poultry production. It is not enough to devise a strong biosecurity program; that program must also be followed by all people that interact within the system. It only takes one dirty boot or tire to ruin months of hard work.

Achieving good results with a flock largely depends on protecting the birds from biosecurity risks

Antibiotic reduction in poultry requires biosecurity

In a poultry operation, feed, people, and equipment constantly need to go in and out of farms and mills. Thus, no biosecurity program can be perfect. The intensity of the program needs to balance the realities of farming and the current disease pressure. The best program takes all of those into account, additionally considers local weather, availability of supplies, and company/farm staff. It is simple enough to be done even when no one is watching and should be easily scalable in case of increased disease pressure.

The rigorousness of a program must be in due proportion to the local circumstances. Having a biosecurity program that is too strict for the perceived disease pressure may result in people taking the path of least resistance. They probably will not follow instructions, especially if there is not enough monitoring and training to reinforce the value of biosecurity. On the other hand, a program with too lax guidelines will not have the desired effect.

The discrepancy between care requirements and separation

Unfortunately, the most valuable animals in an operation are often the most frequently visited by the most people. Pullets need closely monitored feedings, vaccines, and deworming. Breeders need eggs collected and shipped. Hatcheries require a labor force and maintenance. The feed mill and hatchery are central and overlapping points for all areas of the operation. The human and vehicle traffic at these locations must be closely monitored to reduce the risk of rapid disease transmission.

Feed mills are critical sites for biosecurity measures in poultry production

A physical barrier or sign indicating a biosecurity area on a farm or building entrance can help remind people of the program. Of course, these signs will not stop a disease from entering, nor a person determined to enter a site, but they will cause well-trained people to pause and reflect if they are making a sound decision.

Hygiene is a critical factor

It is well documented that hands and feet are significant transmitters of human and animal pathogens. Several studies have shown that hand washing can reduce absenteeism in school-aged children by 29-57%, thanks to a decrease in gastrointestinal diseases (Wang et al., 2017). Hand washing also reduces the incidence of respiratory illness in human populations by up to 21% (Aiello et al., 2008). *Mycoplasmas* can survive for one day in a person's nose, for up to three days in hair, and up to 3-5 days on cotton or feathers (Christensen et al., 1994). Influenza viruses endure 1-2 days on hard surfaces (Bean et al., 1982) and more than a month in pond water (Domanska-Blicharz et al., 2010).

When building a biosecurity program, it is essential to consider the relevant pathogens of concern and the practical ways to reduce their risk of transmission.

How to establish an effective biosecurity program

Generally, biosecurity comprises two important parts:

- Physical biosecurity, being the combination of all the physical barriers such as boot washes, signs, and disinfection
- Operational biosecurity, covering the processes that protect an operation. This includes downtime, visiting birds in age order, time out for birds from people visiting sick flocks, and respect for physical biosecurity measures. Operational biosecurity starts with training, not only regarding the tasks required to be secure, but also the importance of disease prevention.

Establish several zones

When designing a program, consider four zones of increasing cleanliness: off-farm, on-farm, transition zone, and the animal housing area (Figure 1). Each zone should have a control point to reduce the pathogen load coming in, with exact measures depending on current disease status and bird value. These measures include vehicle sanitation and movement restrictions, footwear cleaning and disinfection, and use of personal protective equipment (PPE).

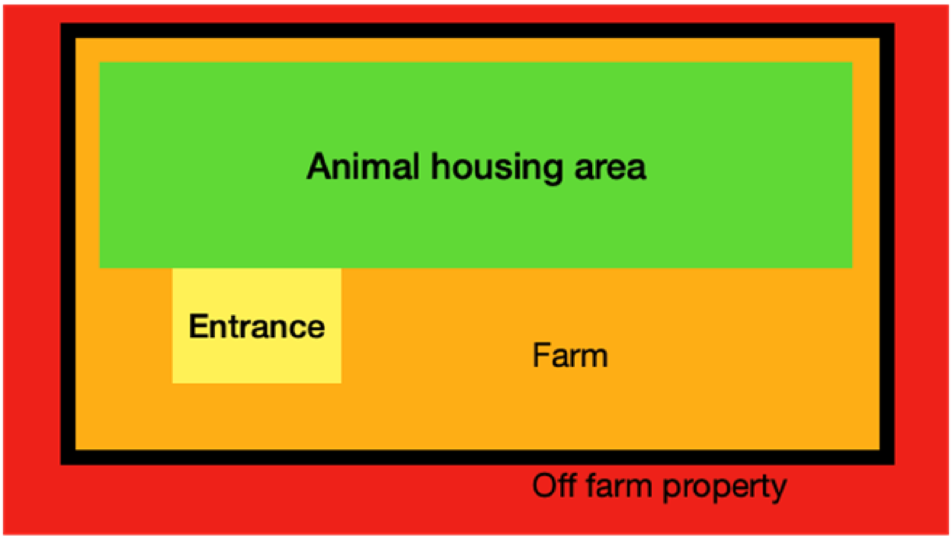


Figure 1: the four "cleanliness zones" in a farm

Increasing cleanliness from off-farm (red) to on-farm (orange) separated by a physical barrier. The entrance to the facility (transition zone; yellow) and the animal housing area (green).

Cleaning and disinfection are two of the core measures

As hands and feet are the main transmitters of pathogens, washing and sanitizing them is a priority. The outside of the house must be left outside, meaning that hands should be washed frequently and shoes sanitized between sites. Shoe covers should be put on when entering the house.

Cleanliness of the cell phone is often overlooked as a source of disease transmission (Olsen et al., 2020). It is a powerful tool: camera, notebook, light… and notoriously hard to clean. Cleaning and disinfection also apply to all shared tools and equipment that enter farms.

Prevent undesired "cohabitants"

Another critical point in biosecurity is the control of undesired pests and farm animals. Baits must be rotated, available where rodents are frequent, appropriately spaced, and secured from non-target animals. Habitats for pests need to be removed, the perimeter of the buildings must be clear of vegetation and debris, feed and grain spills picked up, and equipment stored away from the facilities. Pets and other farm animals should be kept away from the perimeter of the house and should under no circumstance be allowed to enter the facilities.

Tailored biosecurity programs keep your

flock healthy

It is impossible to design a blanket biosecurity program for every operation. Understanding microbiology and disease transmission along with the risk points in a production system will allow a comprehensive plan to be developed. It is important to consider biosecurity as an investment in health and not an optional expense. No program is perfect, but small changes can significantly reduce the risk of pathogens entering the system and leading to major economic and animal welfare issues.

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5 principles to consider when designing biosecurity programmes

Biosecurity is the foundation for all disease prevention programs and all the more important in antibiotic reduction scenarios. It includes the combination of all measures taken to reduce the risk of introduction and spread of diseases and is based on the prevention of and protection against infectious agents. Its fundament is the knowledge of disease transmission processes.

Although biosecurity is considered the cheapest and most effective intervention in antibiotic reduction programmes, compliance is often low and difficult.

The application of consistently high standards of biosecurity can substantially contribute to the reduction of antimicrobial resistance, not only by preventing the introduction of resistance genes into the farm but also by lowering the need to use antimicrobials.

Lower use of antimicrobials with higher biosecurity

Studies and assessments such as those done by (Laanen, *et al*., 2013), (Gelaude, *et al*., 2014), (Postma, *et al*., 2016), (Collineau, *et al*., 2017) and (Collineau, *et al*., 2017a) relate a high farm biosecurity or improvements in biosecurity with lower antimicrobial use. Laanen, Postma, and Collineau studied the profile of swine farmers in different European countries, finding a relation between a high level of internal biosecurity, efficient control of infectious diseases, and a reduced need for antimicrobials.

Others such as Gelaude and Collineau studied the effect of interventions. The former examined Belgian broiler farms, finding a reduction of antimicrobial use by almost 30% when biosecurity and other farm issues were improved within a year. The latter studied swine farms located in Belgium, France, Germany and Sweden, in which antimicrobial use was also reduced in 47% across all farms and observed that farms with the higher biosecurity compliance and who also took a holistic approach, making other changes (e.g. management and nutrition), achieved a higher reduction in antimicrobial use.

Biosecurity interventions pay off

Of course, the interventions necessary to achieve an increased level of biosecurity carry some costs. However, the interventions, especially if taken with other measures such as improved management of new-born animals and nutritional improvements, also improve productivity. The same studies which report that biosecurity improvements decrease antimicrobial use also report an improvement in animal performance. In the case of broilers, Laanen (2013) found a reduction of 0.5 percentual points in mortality and one point in FCR; and Collineau (2017) obtained an improvement during both the pre-weaning and the fattening period of 0.7 and 0.9 percentual points, respectively.

Implementation, application and execution

Although biosecurity is considered the cheapest and most effective intervention in antibiotic reduction programmes, compliance is often low and difficult. The implementation, application, and execution of any biosecurity programme involve adopting a set of attitudes and behaviours to reduce the risk of entrance and spread of disease in all activities involving animal production or animal care. Measures should not be constraints but part of a process aimed at improving the health of animals and people, and a piece of the holistic approach to reduce antibiotics and improve performance.

Designing effective biosecurity programmes: Consider these 5 principles

When designing or evaluating biosecurity programmes, we can identify 5 principles that need to be applied. These principles set the ground for considering and evaluating biosecurity interventions:

1. Separation: ***Know your enemy, but don’t keep it close***

It is vital to have a good separation between high and low-risk animals or areas on the farm, as well as dirty (general traffic) and clean (internal movements) areas on the farm. This avoids not only the entrance but the spread of disease, as possible sources of infection (e.g. wild birds) cannot reach the sensitive population.

2. Reduction: ***Weaken your enemy, so it doesn’t spread***

The goal of the biosecurity measures is to keep infection pressure beneath the level which allows the natural immunity of the animals to cope with the infections, lowering the pressure of infection e.g. by an effective cleaning and disinfection programme, by the reduction of the stocking density, and by changing footwear when entering a production house.

3. Focus: *Hunt the elephant in the room, shoo the butterflies*

In each production unit, some pathogens can be identified as of high economic importance. For each of these, it is necessary to understand the likely routes of introduction into a farm and how it can spread within it. Taking into account that not all disease transmission routes are equally important, the design of the biosecurity programme should focus first on high-risk transmission routes, and only subsequently on the lower-risk transmission routes.

4. Repetition: ***Increasing the probability of infection***

In addition to the probability of pathogen transmission via the different transmission routes, the frequency of occurrence of the transmission route is also highly significant when evaluating a risk (Alarcon, *et al.,* 2013). When designing biosecurity programmes, risky actions such as veterinary visits, if repeated regularly must be considered with a higher risk.

5. Scaling: ***In the multitude, it is easy to disguise***

The risks related to disease introduction and spread are much more important in big; more animals may be infected and maintain the infection cycle, also large flocks/herds increase the infection pressure and increase the risk by contact with external elements such as feed, visitors, etc.

Can we still improve our biosecurity?

Almost 100% of poultry and swine operations already have a nominal biosecurity programme, but not in all cases is it effective or completely effective. BioCheck UGent, a standardised biosecurity questionnaire applied worldwide, shows an average of 65% and 68% of conformity, from more than 1000 broiler and 2000 swine farms between respectively; opportunities to improve can be found in farms globally, and they pay off.

The bottom line

Biosecurity is necessary for disease prevention in any profitable animal production system. To make effective plans, these 5 principles should be applied to choose the right interventions that prevent the entrance and spread of disease. However, maintaining a successful production unit requires a holistic approach in which other aspects of biosecurity need to also be taken seriously, as well as actions to improve in other areas such as management, health and nutrition.

Authors: Technical Team – EW Nutrition

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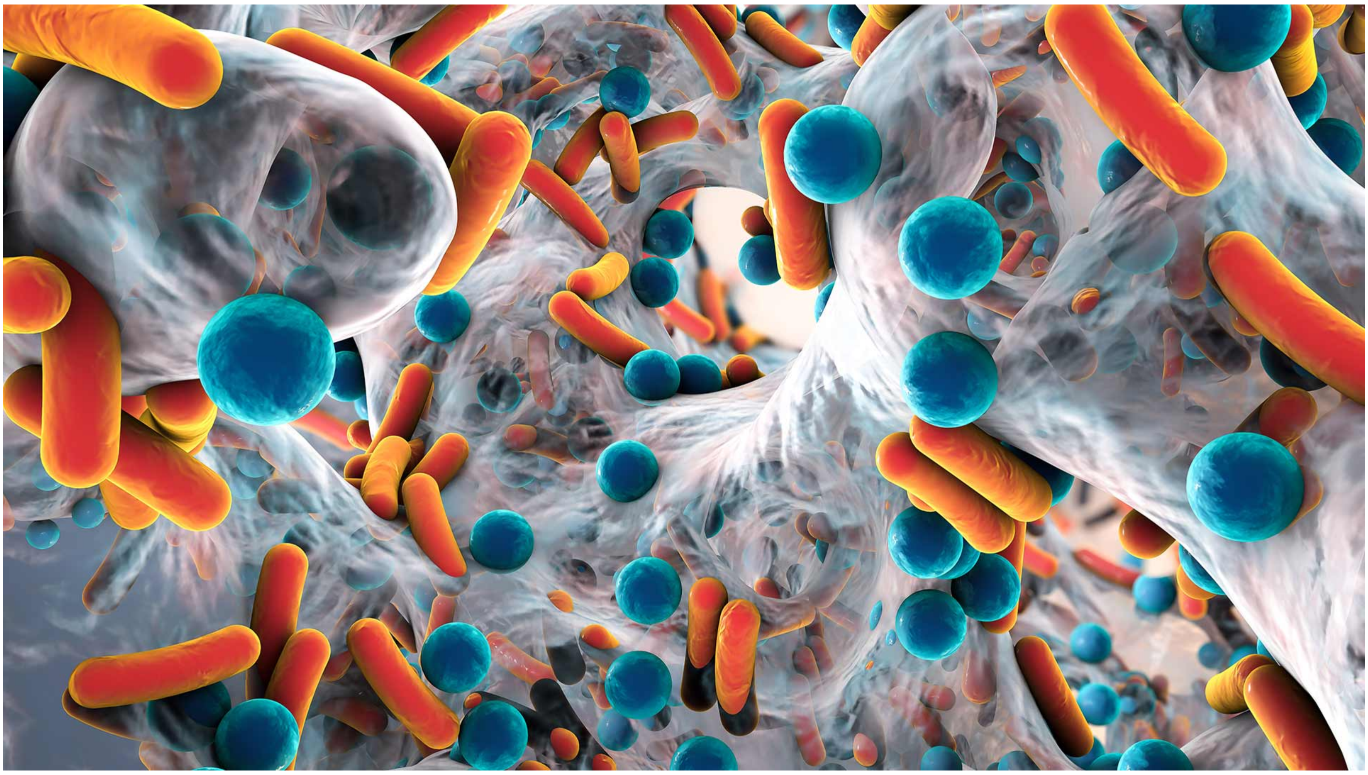
Article published in Pig Progress.

Antibiotic reduction: The increased importance of high-level biosecurity



Biosecurity is the foundation for all disease prevention programs (Dewulf, et al., 2018), and one of the most important points in antibiotic reduction scenarios. It includes the combination of all measures taken to reduce the risk of introduction and spread of diseases. It is based on the prevention of and protection against infectious agents by understating the disease transmission processes.

The application of consistently high standards of biosecurity can substantially contribute to the reduction of antimicrobial resistance, not only by preventing the introduction of resistance genes into the farm but also by lowering the need to use antimicrobials (Davies & Wales, 2019).

Lower use of antimicrobials with higher biosecurity

Several studies and assessments relate that high farm biosecurity status and/or improvements in biosecurity lead to reduced antimicrobial use (Laanen, et al., 2013, Gelaude, et al., 2014, Postma, et al., 2016, Collineau, et al., 2017 and Collineau, et al., 2017a). Laanen, Postma, and Collineau studied the profile of swine farmers in different European countries, finding a relation between the high level of internal biosecurity, efficient control of infectious diseases, and reduced need for antimicrobials.

Reports on reduction on antibiotic use due to farm interventions are also available. Gelaude, et al. (2014), evaluated data from several Belgian broiler farms, finding a reduction of antimicrobial use by almost 30% within a year when biosecurity and other farm issues were improved. Collineau et al. (2017) studied pig farms in Belgium, France, Germany, and Sweden, in which the use of antibiotics was reduced on average by 47% across all farms. The researches observed that farms with the most strict biosecurity protocols, higher compliance, and who also took a multidisciplinary approach (making other changes, e.g. in management and nutrition), achieved a greater reduction of antibiotic use.

Biosecurity interventions pay off

Of course, the interventions necessary to achieve an increased level of biosecurity carry some costs. However, the interventions have proven to also improve productivity. Especially if taken with other measures such as improved management of newborn animals and nutritional improvements. The same studies which report that biosecurity improvements decrease antibiotics use also report an improvement in animal performance. In the case of broilers, Laanen (2013) found a reduction of 0.5 percentual points in mortality and one point in FCR; and Collineau (2017) reported a reduction in mortality in pigs during both the pre-weaning and fattening period of 0.7 and 0.9 percentual points, respectively.

Execution

Although biosecurity improvements and other interventions necessary for antibiotic reduction programs are well known, continuous compliance of these interventions is often low and difficult. The implementation, application, and execution of any biosecurity program involve adopting a set of attitudes and behaviors to reduce the risk of entrance and spread of disease in all activities involving animal production or animal care. Measures should not be constraints but part of a process aimed to improve health of animals and people, and a piece of the multidisciplinary approach to reduce antibiotics and improve performance.

Designing effective biosecurity programs: consider five principles

When designing or evaluating biosecurity programs, we can identify five principles that need to be applied (Dewulf, et al., 2018). These principles set the ground for considering and evaluating biosecurity interventions:

1. Separation: Know your enemy, but don't keep it close

It is vital to have a good definition of the perimeter of the farm, a separation between high and low-risk animals, and dirty and clean internal areas on the farm. This avoids not only the entrance but the spread of disease, as possible sources of infection (e.g. animals being introduced in the herd and wild birds) cannot reach the sensitive population.

2. Reduction: Weaken your enemy, so it doesn't spread

The goal of the biosecurity measures is to keep infection pressure beneath the level which allows the natural immunity of the animals to cope with the infections (Dewulf, et al., 2018). Lowering the pressure of infection e.g. by an effective cleaning and disinfection program, by the reduction of the stocking density, and by changing footwear when entering a production house.

3. Focus: Hunt the elephant in the room, shoo the butterflies

In each production unit, some pathogens can be identified as of high economic importance due to their harm and frequency. For each of these, it is even more important, to understand the likely routes of introduction into a farm and how it can spread within it. Taking into consideration that not all disease transmission routes are equally significant, the design of the biosecurity program should focus first on high-risk pathogens and transmission routes, and only subsequently on the ones lower-risk (Dewulf, et al., 2018).

4. Repetition: When the danger is frequent, the probability of injury is increased

In addition to the probability of pathogen transmission via the different transmission routes, the frequency of occurrence of the transmission route is also highly significant when evaluating a risk (Alarcon, et al., 2013). When designing biosecurity programs, risky actions such as veterinary visits, if repeated regularly must be considered with a higher risk.

5. Scaling: In the multitude, it is easy to disguise

The risks related to disease introduction and spread are much more important in big farms (Dorea, et al., 2010); more animals may be infected and maintain the infection cycle, also large flocks/herds increase the infection pressure and increase the risk by contact with external elements such as feed, visitors, etc.

Can we still improve our biosecurity?

Almost 100% of poultry and swine operations already have a nominal biosecurity program, but not in all cases is it fully effective. BioCheck UGent, a standardized biosecurity questionnaire applied in swine and broiler farms worldwide, shows an average of 65% and 68% in conformity, respectively, from more than 3000 farms between both species (UGent, 2020). Therefore, opportunities to improve can be found in farms globally, and they pay off.

To find these opportunities, consider three situations you need to know:

1. **Know your menace:** Identify and prioritize the disease agents of greatest concern for your production system by applying the principles of **focus** and **repetition**. Consider the size of the facility when evaluating risks applying the **scaling**
2. **Know your place:** Conduct an assessment of the facility. A starting point is to define the *status quo*. For that, operation-existing questionnaires or audits can be used. However, the "new eyes principle" should be applied and an external questionnaire such as BioCheck UGent (biocheck.ugent.be) is recommended. The questionnaire will help you identify gaps in your **biosecurity plan** as well as **processes** that may be allowing pathogens to enter or move from one location to another, and measures that can be implemented applying the principles of **separation** and **reduction.**
3. **Know your processes:** Implement processes and procedures that apply the biosecurity principles and help to eliminate, prevent, or minimize the potential of disease. A deep evaluation of the daily farm processes will aid in risk mitigation, considering, among others, movement of personnel, equipment, and visitors, the entrance of pets, pests and vermin, dealing with deliveries and handling of mortality and used litter.

Compliance – The weak link in biosecurity programs

Achieving systematic compliance of biosecurity protocols on a farm is a complex, interactive, and continuous process influenced by several factors (Delabbio, 2006) and an ongoing challenge for animal production facilities (Dewulf, et al., 2018). Thus, it is clear that the biosecurity plan can only be effective if everyone on the operation follows it constantly, i.e. if everyone performs in **compliance**.

Compliance can be defined as the extent to which a person's behavior coincides with the established rules. Thus, compliance with biosecurity practices should become part of the culture of the facility. Poor compliance in relation with biosecurity can be connected to:

- Lack of knowledge or understanding of the biosecurity protocols (Alarcon, et al., 2013; Cui & Liu, 2016; Delpont, et al., 2020)
- Lack of consequences for non-compliance (Racicot, et al., 2012a)
- A company culture of inconsistent or low application of biosecurity protocols (Dorea, et al., 2010)

In general terms, compliance with biosecurity procedures has been found to be incomplete in different studies (Delpont, et al., 2020; Dorea, et al., 2010; Gelaude, et al., 2014; Limbergen, et al., 2017). In one study (Racicot, et al., 2011) used hidden cameras, to asses biosecurity compliance in Quebec, Canada and found 44 different biosecurity fails made by 114 individuals (farm workers and visitors) in the participating poultry farms, over the course of 4 weeks; in average four mistakes were made per visit. The most frequent mistakes were ignoring the delimitation between dirty and clean areas, not changing boots, and not washing hands at the entrance of the barns; these three mistakes were committed in more than 60% of the occasions, regardless of being farm employees or visitors. These are frequent breaches not only of those farms in Quebec but found frequently in many animal production units around the world and have a high probability of causing the entrance and spread of pathogens.

How to create a high biosecurity culture: start now!

Creating, applying, and maintaining a biosecurity culture is the most effective way to make sure that compliance of the biosecurity program and procedures is high on the farm. Decreasing, therefore, the probability of entrance and spread of pathogens, reducing the use of antimicrobials, and maintaining animal health. Some actions are recommended in order to achieve a high biosecurity culture:

1. Name an accountable person

Every operation should have a biosecurity coordinator who is accountable for developing, implementing, and maintaining the biosecurity program.

This important position should be appointed having in mind that certain personality traits may facilitate performance and execution of the labor (Delabbio, 2006; Racicot, et al., 2012; Laanen, et al., 2014; Delpont, et al., 2020) such as responsibility, orientation to action, and being able to handle complexity. Additionally, expertise – years working in the industry – and orientation to learn are strategic (Racicot, et al., 2012).

2. Set the environment

When the farm layout is not facilitating biosecurity, compliance is low (Delabbio, 2006), thus the workspace should facilitate biosecurity workflows and at the same time make them hard to ignore (Racicot, et al., 2011).

3. Allow participation

It is important to mention that not only the management and the biosecurity coordinator are responsible for designing and improving biosecurity procedures. Biosecurity practices must be owned by all the farm workers and should be the social norm.

The annual or biannual revision of biosecurity measures should be done together with the farm staff. This not only serves the purpose of assessing compliance but also allows the personnel to suggest measures addressing existing -often overlooked– gaps, and to be frank about procedures that are not followed and the reasons for it. At the same time, participation increases accountability and responsibility for the biosecurity program.

4. Train for learning

Don't take knowledge for granted. Even when a person has experience in farm work and has been working in the industry for several years, their understanding and comprehension around biosecurity may have gaps.

People are more likely to do something when they see evidence of the activity's benefit. Therefore, if workers are told about the effectiveness of the practices, showing the benefits of biosecurity and analyzing the consequences of non-compliance, they are most likely to follow the procedures (Dewulf, et al., 2018). Knowledge of disease threats and symptoms also improves on-farm biosecurity (Dorea, et al., 2010), thus workers should recognize the first symptoms of disease in animals and act upon them.

Discussion of 'What if…?' scenarios to gain an understanding of the key aspects of farm biosecurity should be held on a regular basis. Workers should see examples of the benefits of compliance – and risks of noncompliance – as part of their training.

5. Lead by example

A high biosecurity culture requires everyone to comply regardless of status.

Personnel practice of biosecurity procedures is not only affected by the availability of resources and training, but also by the position that management takes on biosecurity and the feedback provided. The management and owners must transmit a message of commitment to the farm personnel, owning and following biosecurity practices, procedures and protocols, giving positive and negative feedback on the personnel's compliance, supplying information on farm performance and relating it with biosecurity compliance and ensuring adequate resources for the practice of biosecurity (Delabbio, 2006).

When necessary, management also should enforce personnel compliance by disciplinary measures, firings, and creating awareness about the consequences of disease incidence. Nevertheless, the recognition of workers' contribution to animal health performance also has a positive impact on biosecurity compliance (Dorea, et al., 2010).

The bottom line

Biosecurity is necessary for disease prevention in any animal production system. Actions and interventions that prevent the entrance and spread of disease in a production unit have a pay-off as they often lead to performance improvements and lower antimicrobial use. Maintaining a successful production unit requires a multidisciplinary approach in which biosecurity compliance needs to be taken seriously and also actions to improve in other areas such as management, health, and nutrition.

By Technical Team, EW Nutrition

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China lockdown sends ripples across international animal production

For animal production, just as for many other sectors that trade globally, China is a central node within our industry's complex supply chains. As China is starting to lift its restrictions again, what can we say about the knock-on effects of China's lock-down on animal production to date? And what happens now that these measures are replicated in other markets?

Soaring Chinese demand for chicken and pork imports

Wuhan, the capital of Hubei province in China, is home to more than 11 million inhabitants and to the Huanan Seafood Wholesale Market, where the first human infection with SARS-CoV-2 likely took place. From January 23, 2020, onwards, Chinese authorities effectively put all of Wuhan under quarantine: Places and trains could no longer leave the city, buses, subways, and ferries were suspended. Lock-down measures were extended to much of Hubei province and beyond.

According to analysts and Chinese state media, poultry production was seriously affected: Transport restrictions prevented feed such as soybean meal from being delivered to poultry farms, forcing farmers to cull millions of young birds. Hence, the first noticeable ripple effects on international animal production were felt in terms of Chinese import demand. In February, the Financial Times reported that China lifted the ban on importing live chickens from the US to tackle the worsening protein shortage.

This protein shortage is, of course, a longer-term issue due to African Swine Fever's decimation of the Chinese hog population by 40% that has sent pork prices skyrocketing in the past year and fueled inflation. According to Nikkei Asian Review, the added pressure of COVID-19-related domestic transport disruption on pork prices has led to a boost in Chinese demand for imported meat. The U.S. Meat Export Federation reported that US pork exports to China in January 2020 were almost ten times higher than the year before, reaching 74,350 metric tons. However, pork exporters were and still are having trouble getting their pork into China because of the lockdown measures' paralyzing effect on sea freight.

Prices hikes for vitamins and amino acids

By the same token, Chinese manufacturers were and still are having trouble getting their products out of China, or even more fundamentally, producing them in the first place. Much of the world's supply of feed ingredients such as B vitamins, vitamin D3, threonine, and lysine is produced in China. The ripple effect of China's lockdown on global animal production supply chains has thus been keenly felt in terms of the availability and pricing of multiple vitamins and amino acids.

Delayed January exports are starting to trickle in, but disruptions in shipping links are expected to continue for some time yet – and supply chain bottlenecks translate into price hikes. Analysts report vitamin and amino acid price hikes of varying magnitude relative to pre-pandemic levels, and markets appear to be getting more volatile rather than more stable. Among others, Nan-Dirk Mulder, Senior Global Specialist for Animal Protein at Rabobank, therefore, expects animal health and feed additive prices to continue to rise in 2020.

China restrictions ease, but everyone else under lockdown

If we look at China in isolation and assume that its lifting of restrictions will steadily continue, there is reason to be cautiously optimistic. Martijn de Cocq, Lead Analyst at FeedInfo News Service, reports that Chinese production of premix, compound feed, and amino acids and vitamins is back to 80-90% of 2019 levels. Against a backdrop of backlogs, low stock levels, and shortages of certain raw materials, manufacturers are playing catch-up now to meet both domestic and export demand, putting pressure on spot prices for various feed additives and also on seaport capacity.

Chinese economic recovery also bodes well for animal product import demand. Despite the delays and disruptions to supply chains and trade flows caused by COVID-19, Iowa State University researchers Wendong Zhang and Tao Xiong, for instance, anticipate American exports of poultry, pork, and beef products to China to grow from $3 billion to $5 billion in 2020.

However, even if China bounces back quickly, eschews further rounds of lockdown measures, and returns to producing and shipping its usual volumes of feed additives (albeit at temporarily higher prices) – in terms of global animal production, we also have to ask ourselves what happens in the target markets for Chinese exports.

Deciding factors: transport and labor

Specifically, we have to consider domestic transport logistics, e.g., how raw materials are getting from ports to feed manufacturing facilities how end products are getting to farms. The undisrupted functioning of the feed supply chain is indispensable for animal production. Hence, many countries have already explicitly classified feed as an essential good that needs to be exempt from transport restrictions imposed to stem the spread of Sars-Cov-2. The EU Commission, for instance, has adopted a directive on "green lanes" to facilitate cross-border freight transports, including that of feedstuffs. The other hot-button cross-border topic, which eventually will affect animal feed as well, is, of course, seasonal labor, which is urgently required for spring planting in both Europe and North America.

The big dark cloud hovering over every sector within animal production is the question of what would happen if they are severely affected by staff shortages due to coronavirus infections. We simply don't know. All lockdown measures put in place right now, at a considerable social and economic cost, are about preventing a scenario where large parts of the population are simultaneously ill. However, at the level of, say, a feed mill or a farm, even just a few infections among staff, could require them to suspend operations, with unthinkable consequences for animal welfare and food security.

In the absence of a crystal ball, we have to accept a certain baseline of unnerving uncertainty about future developments and focus on the positives: Globally, feed manufacturing is going strong, and animal producers are busier than ever to play their role in maintaining reliable food supply chains during these extraordinary times.

Corona – Must We Fear Transmission from Livestock to Humans?

SARS-CoV-2 is causing one of the worst global challenges in the 21st century right now. The virus is a member of the family of coronaviridae and belongs to the RNA-viruses. It is assumed that the virus was transmitted by wild animals on a wet market in China. If the virus came from wild animals, is it possible that it can also be transmitted to our farm animals and vice versa? There is considerable confusion in the market. In India, e.g., sales of poultry meat broke down by 80% since January, due to rumors that one could catch the virus from eating chicken.

Corona – nothing new in agriculture!

For people working in the agricultural sector, coronaviruses are not unknown. Cattle producers often fight against diarrhea in newborn calves and against winter dysentery in young adult cattle. Pig farmers know Porcine Epidemic Diarrhoea (PED) and Transmissible Gastroenteritis (TGE) very well. Poultry farmers vaccinate their animals against infectious bronchitis (IB). Are these diseases all caused by the same viruses? No! Different members of the coronavirus family are responsible.

Most of the coronaviruses are species – and tissue – specific

To infect animals or humans, the spike-proteins forming the crown – the "corona" – of the coronavirus must bind to receptor molecules on the target cells of the host's tissues. The binding is highly specific, just like a lock and its specific key go together, or how an antibody binds to a particular pathogen. SARS-CoV-2, for example, needs a particular cell membrane protein (angiotensin-converting enzyme 2 – ACE2) to enter human cells; TGE viruses, on the other hand, depend on the porcine aminopeptidase N (ANPEP). The cells of pigs have other receptor molecules than the cells of poultry. The cells of the gastrointestinal tract are different from the cells of the respiratory tract (Russ, 2020).

Table: examples for the different coronaviruses in livestock and humans (adapted from Ackermann, 2016)

Virus	Disease	Species	Genus*
TGEV PEDV FCoV-I	Transmissible gastroenteritis Porcine epidemic diarrhea Feline infectious peritonitis (FIP)	Pigs Pigs Cats	α
BCoV HEV MERS-CoV SARS-CoV SARS-CoV-2	Diarrhea in newborn calves; winter dysentery Vomiting and wasting disease Middle East respiratory syndrome Severe acute respiratory syndrome COVID-19	Cattle Pigs Humans Humans Humans	β
IBV TCV	Infectious bronchitis Blue comb disease	Poultry Poultry	γ
PDCoV	Porcine delta coronavirus	Pigs	δ

*for the allocation to the genus, one crucial factor is the viral protein nsp 1.

Corona in Pigs

For pigs, five coronaviruses are relevant. The porcine epizootic diarrhea virus (PEDV) and the transmissible gastroenteritis virus (TGEV) belong to the α genus. They show a high affinity to the epithelial cells of the gastrointestinal tract. The porcine respiratory coronavirus (PRCV) is also a representative of the α genus, but does not show any affinity to the gastrointestinal epithelial cells. It causes respiratory diseases. The other viruses are the hemagglutinating encephalomyelitis virus responsible for the vomiting and wasting disease and belonging to the β-genus, and the porcine delta coronavirus (PDCoV), causing diarrhea (Stiebnitz, 2017).

Corona in Poultry

Infectious bronchitis caused by a coronavirus belonging to the γ genus is one of the major economically critical respiratory diseases in poultry. As it also affects the kidney and the reproductive tract, the consequences are kidney damage, decreased egg production, and bad egg quality. A further significant problem of IB in poultry is the rapid spread. Within 48 hours, a whole flock can be infected and remains a virus reservoir, even after recovery. Usually, the infection is horizontal, from hen to hen, not from hen to the chick. However, infection via contaminated eggs shell in the hatcheries is also possible (MacLachlan and Dubovi, 2016).

Corona in cattle

The symptoms associated with bovine coronaviruses are calf diarrhea, winter dysentery (hemorrhagic diarrhea) in adult cattle, and respiratory infections in animals of various ages (MacLachlan and Dubovi, 2016). The bovine coronavirus belongs to the ß genus. The bovine coronavirus is not as host-specific as many other coronaviruses. It can infect dogs, turkeys, and other wild ruminants such as waterbucks, giraffes, or white-tailed deers.

Can SARS-CoV-2 also be exchanged between humans and livestock?

SARS-CoV-2, like the MERS-CoV (Middle East Respiratory Syndrome) and the SARS-CoV (2002/03), belongs to the ß genus of coronaviruses. All three can infect animals and humans, which can be seen from the way they spread: SARS-CoV originated from bats, MERS-CoV was transmitted by camels, and for SARS-CoV-2, bats (Zhou et al., 2020) but also pangolins (Zhang, 2020) are assumed to be the source. But not livestock animals.

There is one known case of a SARS-CoV infected pig, which was discovered in China in the context of research on the SARS epidemy in 2002 (Chen, 2005). Scientists from the Chinese Academy of Sciences in Beijing examined six animal species living in close contact with humans and found this one pig infected by SARS-CoV of human origin. As the only person having contact with the pig was tested negative for the coronavirus several times, it was concluded that the infection likely came from virus-contaminated feed. The pigs in rural areas in China are often fed the leftovers from restaurants.

For now: keep calm

Today, there is no scientific indication that livestock can contract SARS-CoV-2 from humans or vice versa. In Germany, the Friedrich Löffler Institute (2020), a leading research institute on epizootic diseases, is conducting extensive studies at the moment to better understand the sensitivity of animals towards SARS-CoV-2. Reliable results are expected earliest at the end of April. Until then, let's keep calm, and behave responsibly to weather these unsettling times.

By Inge Heinzl, Editor EW Nutrition

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