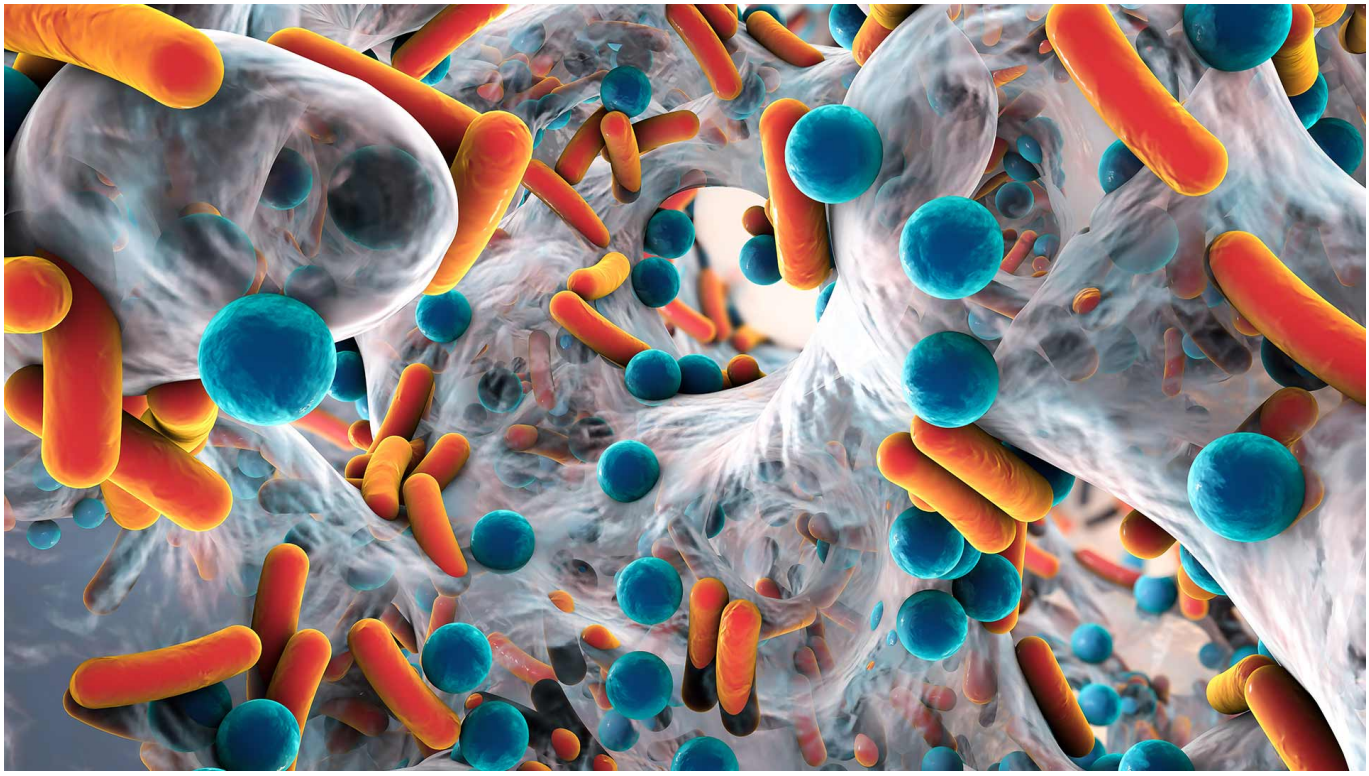
How producers keep the egg supply chain going amid COVID-19

The Covid-19 pandemic has increased consumer demand for eggs. This article discusses how the egg supply chain, from layer farms to supermarkets, works amid disruptions caused by Covid-19.

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.

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References

Alarcon, P., Wieland, B., Pereira, A. L. & Dewberry , C., 2013. Pig Farmer's perceptions, attitudes, influences, and management of information in the decision-making process for disease control. *Preventive Veterinary Medicine,* 116(3).

Collineau, L. et al., 2017. Profile of pig farms combining high performance and low antimicrobial usage within four European countries. *Veterinary Record,* Volume 181.

Collineau, L. et al., 2017a. Herd-specific interventions to reduce antimicrobial usage in pig production without jeopardizing technical and economic performance. *Preventive Veterinary Medicine.*

Cui, B. & Liu, Z. P., 2016. Determinants of Knowledge and Biosecurity Preventive Behaviors for Highly Pathogenic Avian Influenza Risk Among Chinese Poultry Farmers. *Avian Diseases,* 60(2).

Davies , R. & Wales, A., 2019. Antimicrobial Resistance on Farms: A Review Including Biosecurity and the Potential Role of Disinfectants in Resistance Selection. *Comprehensive Reviews in Food Science and Food Safety.*

de Gussem, M. et al., 2016. *Broiler Signals.* First ed. Zutphen: Roodbont Publishers.

Delabbio, J., 2006. How farmworkers learn to use and practice biosecurity. *Journal of Extension,* 44(6).

Delpont, M. et al., 2020. Determinants of biosecurity practices in French duck farms after an H5N8 Pathogenic Avian Influenza epidemic: The effect of farmer knowledge, attitudes and personality traits. *Transboundary and Emerging Diseases.*

Dewulf, J. et al., 2018. *Biosecurity in animal production and veterinary medicine.* First ed. Den Haag: Acco Nederland.

Dorea, F., Berghaus, R., Hofacre, C. & Cole, D., 2010. Biosecurity protocols and practices adopted by growers on commercial poultry farms in Georgia USA. *Avian Diseases,* 54(3).

Gelaude, P. et al., 2014. Biocheck.UGent: A quantitative tool to measure biosecurity at broiler farms and the relationship with technical performances and antimicrobial use. *Poultry Science.*

Laanen, M. et al., 2014. Pig, cattle, and poultry farmers with a known interest in research have comparable perspectives on disease prevention and on-farm biosecurity. *Preventive Veterinary Medicine.*

Laanen, M. et al., 2013. Relationship between biosecurity and production/antimicrobial treatment characteristics in pig herds. *The Veterinary Journal,* 198(2).

Limbergen, T. et al., 2017. Scoring biosecurity in European conventional broiler production. *Poultry Science.*

Postma, M. et al., 2016. Evaluation of the relationship between the biosecurity status, production parameters, herd characteristics, and antimicrobial usage in farrow-to-finish pig production in four EU countries. *Porcine Health Management.*

Racicot, M., Venne, D., Durivage, A. & Vaillancourt, J.-P., 2011. Description of 44 biosecurity errors while entering and exiting poultry barns based on video surveillance in Quebec, Canada. *Preventive veterinary medicine,* Volume 100.

Racicot, M., Venne, D., Durivage, A. & Vaillancourt, J.-P., 2012a. Evaluation of strategies to enhance biosecurity compliance on poultry farms in Quebec: Effects of audits and cameras. *Preventive veterinary medicine,* Volume 103.

Racicot, M., Venne, D., Durivage, A. & Vaillancourt, J.-P., 2012. Evaluation of the relationship between personality traits, experience, education, and biosecurity compliance on poultry farms in Quebec, Canada. *Preventive veterinary medicine,* Volume 103.

UGent, b., 2020. *biocheck UGent.* [Online]
Available at: www.biocheck.ugent.be

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

References:

Ackermann, Matthias. "Taxonomie und Familienalbum der Viren." *Beilagen zur Vorlesung Virologie 2015/16 Teil II* (2016). https://www.vetvir.uzh.ch/dam/jcr:b55d076d-f488-47c7-87b3-774f9d05c0f2/Vi_Fam2016%281%29.pdf

Chen, W., M. Yan, L. Yang, B. Ding, B. He, Y. Wang, X. Liu, C. Liu, H. Zhu, B. You, S. Huang, J. Zhang, F. Mu, Z. Xiang, X. Feng, J. Wen, J. Fang, J. Yu, H. Yang and J. Wang. „SARS-associated coronavirus transmitted from human to pig." *Emerg. Infect Dis.* 11 no. 3 (2005): 446-8. https://doi.org/10.3201/eid1103.040824

Daly, Russ. "COVID-19 and Livestock: Is there a connection?." *Swineweb* (2020). http://www.swineweb.com/covid-19-and-livestock-is-there-a-connection-by-russ-daly-professor-sdsu-extension-veterinarian-state-public-health-veterinarian/

Friedrich Löffler Institut. SARS-CoV-2 / COVID-19: Umgang mit Haus- und Nutztieren. Short Messages. 02/28/2020. https://www.fli.de/en/news/short-messages/short-message/sars-cov-2-covid-19-umgang-mit-haus-und-nutztieren/

MacLachlan, N. James and Edward J. Dubovi (Eds.). „Coronaviridae." Fenner's Veterinary Virology (Fifth Edition, 2016). Academic Press. Copyright: Elsevier Inc. https://doi.org/10.1016/C2013-0-06921-6

Stiebnitz, Christoph Gunther. „Charakterisierung und klinische Verlaufsuntersuchung aktueller PEDV-Feldinfektionen in deutschen Schweinebeständen unter Berücksichtigung betriebsspezifischer Managementfaktoren“. *Inaugural Dissertation*, München, 2017. urn:nbn:de:bvb:19-208698. https://edoc.ub.uni-muenchen.de/20869/1/Stiebritz_Christoph.pdf

WHO. “Middle East respiratory syndrome coronavirus (MERS-CoV).” *Factsheets. WHO* (2019). https://www.who.int/news-room/fact-sheets/detail/middle-east-respiratory-syndrome-coronavirus-(mers-cov)

Zhang, Tao, Qunfu Wu and Zhigang Zhang. “Probable Pangolin Origin of SARS-CoV-2 associated with the COVID-19 Outbreak.” *Current Biology* 30 (2020):1-6. https://doi.org/10.1016/j.cub.2020.03.022

Zhou, Peng, Xing-Lou Yang, Xian-Guang Wang, Ben Hu, Lei Zhang, Wei Zhang, Hao-Rui Si, Yan Zhu, Bei Li, Chao-Lin Huang, Hui-Dong Chen, Jing Chen, Yun Luo, Hua Guo, Ren-Di Jiang, Mei-Qin Liu, Ying Chen, Xu-Rui Shen, Xi Wang, Xiao-Shuang Zheng, Kai Zhao, Quan-Jiao Chen, Fei Deng, Lin-Lin Liu, Bing Yan, Fa-Xian Zhan, Yan-Yi Wang, Geng-Fu Xiao and Zheng-Li Shi. “A pneumonia outbreak associated with a new coronavirus of probable bat origin.” Nature 579 (2020):270-273 https://doi.org/10.1038/s41586-020-2012-7

How COVID-19 is affecting animal producers – and what to focus on right now

As the novel coronavirus pandemic continues to spread and large parts of the world are under lock-down, meat, dairy, and egg producers are working hard to maintain production in the face of many uncertainties. Let’s take stock of three major challenges for animal production businesses – and consider three elements of the multi-pronged “solution” our industry is creating to this unprecedented situation.

Demand patterns are volatile

Stock-piling and panic buys in light of quarantine and social distancing measures have driven up consumer demand for non-perishable, shelf-stable, and frozen food. Accordingly, sales of products such as eggs, long-life milk, and fresh chicken have strongly picked up, while demand for restaurant cuts is waning. Animal producers are trying hard to increase retail processing to meet consumer needs, yet future demand slumps are looming: eventually, consumers will purchase less while they use up their provisions.

Moreover, the economic knock-on effects of this pandemic might include higher unemployment and long-term pressure on the hospitality industry. Dan Sumner, an agricultural economist at the University of California, also expects longer-term reduced export demand from areas strongly affected by the virus.

Inputs: feed additive price hikes and labor shortages

Measures to contain COVID-19 have led to multiple production and transport disruptions in China, where much of the global supply of ingredients such as vitamins, threonine, and lysine, as well as fertilizers, originates. According to Nan-Dirk Mulder, Senior Global Specialist for Animal Protein at Rabobank, these developments will drive up animal health and feed additive prices in 2020.

Animal producers are also concerned about the pandemic's impact on labor availability. Staff shortages due to sickness, quarantine, childcare issues, and movement restrictions for seasonal labor could have severe consequences, from productivity losses to major animal welfare challenges. The National Pork Producers Council in the US, for example, warns that "the specter of market-ready hogs with nowhere to go is a nightmare for every pork producer in the nation."

Misinformation can create hazards

The media landscape, in particular social media, is rife with misinformation about COVID-19. There is no scientific evidence that farm animals can contract, transmit, or spread the SARS-CoV-2 virus, but fake news along these lines may have a detrimental impact on animal production.

In India, rumors were spread that the novel coronavirus can be transmitted through the consumption of chicken. This has led to a 70% drop in the wholesale price of chicken, as reported by Minister of State Sanjeev Kumar Balyan, putting tremendous pressure on the local poultry industry. Knock-on effects are already felt by feed companies, equipment providers, corn, and soybean growers – but also fish, meat, and egg producers as the rumors have morphed into a general suspicion towards animal protein.

Biosecurity and planning matter more than ever

Many of the prevention and control measures against SARS-Cov-2, such as tight hygiene standards and limiting visitors to facilities, are familiar to animal producers. Biosecurity is of paramount importance to prevent the spread of diseases, not least devastating pests such as Highly Pathogenic Avian Influenza and African Swine Fever. Now is the moment to reinforce biosecurity protocols, on farms and in processing plants, to keep both workers and animals safe.

Experts at the Friedrich Löffler Institute, a German swine producer interest group, have also stressed that producers need to develop feasible contingency plans in case key staff members need to self-isolate. Businesses are also exploring how automation can help safeguard production in case of labor disruptions; agricultural drone manufacturers are reporting significant increases in sales already.

Feed additives to safeguard performance

Nick Major, president of the European Feed Manufacturers' Federation (FEFAC), has urged the European Commission to recognize "feed as essential goods in the EU COVID-19 guidelines, which is crucial to (…) prevent supply chain disruptions and shortages of essential nutrients to the EU farm animal population."

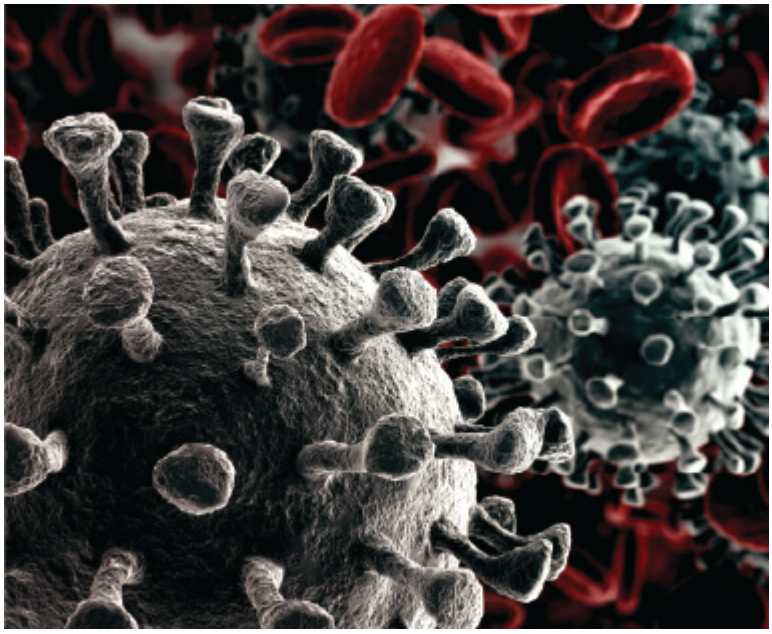
As border controls, transport restrictions, and port closures upend the normal flow of raw feed materials, quality concerns with regard to the origin and storage conditions, e.g. mycotoxin contamination, are becoming topical. Especially given the added issue of how to guarantee appropriate care for their animals during labor shortages, producers need to, therefore, prioritize their feed additive portfolio. Intelligent feed additive solutions have been proven to support animal performance in challenging situations, boosting gut health and immune functions.

Collaborate and communicate

Now is the moment to remind people that meat, dairy, and egg production is part of a society's critical agricultural infrastructure. Industry associations and advocacy groups are working hard to prevent the spread of misinformation and to ensure that politicians and regulators do not gloss over the needs of producers and farm animals. These include access to feed supplies and practicable labor arrangements, but also guaranteed allocations of protective equipment, without which safe operations are not possible.

This crisis highlights what should be obvious: animal producers are in the business of "what really matters," providing safe and nutritious food for everyone. This is a time to rally – if anyone knows how to deal with uncertainty, volatility, and rapidly changing circumstances, it is animal production.

COVID-19: What we are doing and what you can do



Dear friends,

Over the past few weeks, we have all found ourselves facing a situation never before seen on this scale. How are we, at EW Nutrition, dealing with it? In a few words: with responsibility to customers, partners, and employees. To find out what we are doing as a company, but also to find out how COVID-19 might spread and what YOU can do to limit risks to yourselves and others, read more here.

What we are doing as a company

Recognizing the challenge posed by COVID-19 in our times, we at EW Nutrition remain on high alert, focused primarily on delivering solutions to our customers and security to our partners and employees.

No Coronavirus cases or known contact with such exist at present among our international teams, yet the

EW Nutrition management is acting responsibly on three levels:

- Coordinating operations to ensure on-time and on-standard delivery to our customers
- Postponing/canceling all events that involve any relatively large group of customers and/or employees, regardless of the costs to the company, in order to ensure the health and safety of everyone involved (three events have been canceled/postponed so far: in Turkey, Germany, and Mexico)
- Coordinating with employees to ensure maximum levels of hygiene are observed, as well as best practices of social distancing and self-isolation in order to "flatten the curve". Where necessary and possible, remote work has been encouraged.

Moreover, to stay ahead of any potential disruptions and to keep on top of the news, the management team at EW Nutrition meets every morning for updates and sends out periodical communications to all concerned.

With the measures it has adopted and the positive code of conduct we are modeling, EW Nutrition is acting preemptively and responsibly to address any present and future challenges that the COVID-19 pandemic may raise. We are confident of our company's capacity to provide stability and value to our customers, partners, and employees.

How does the virus spread?

New research from the University of Austin, Texas, shows that more than 10% of the cases are transmitted by people without any observable symptoms – what is knows as "asymptomatic transmission". This type of transmission makes containment more difficult, warranting "extensive control measures including isolation, quarantine, school closures, travel restrictions and cancellation of mass gatherings."

Since this is a new virus, it is impossible to say with 100% certainty how it is spread. However, it is almost certain that one of the transmission pathways is through the cough or sneeze droplets from infected persons, even when these infected persons do not show very clear signs of the disease.

It is also possible that contact with objects on which such droplets reside may be a secondary pathway of transmission. So far, it is not known for certain how long COVID-19 can survive outside the body, but a related virus (MERS-CoV) was known to survive for up to 60 minutes in the air. Bear in mind, therefore, that objects in public spaces and confined spaces such as restrooms and elevators might also be sources of infection.

What can you do to reduce risks?

Social distancing

Keep a distance of at least a meter from other people: not just those who sneeze, cough or in any way appear to be ill, but generally from people you know have spent any time outside or with other people. This way you minimize the risk of being hit by droplets of saliva from people who may be already infected or carry the virus.

It is a radical practice, yet it is proven to be very effective. This is the solution that many countries that were hit by the SARS epidemic, for instance, adopted to curb the virus's explosive growth.

Wash your hands

Soap and water or an alcohol-based hand sanitizer are the best way to keep viruses away. Wash your hands thoroughly not just every two hours, but literally as often as you can, and especially after contact with other people or objects in public places.

Avoid public places

This includes bars, restaurants, theaters or any other places that may not already be closed. Since it is not yet clear how long coronavirus survives in the air or on objects, even places that may appear safe could potentially still harbor active viruses.

Assist the elderly – cautiously

The elderly and those with preexisting conditions are known to be at higher risk than the rest of the population. If you are an active member of the population outside these groups, it is important to minimize contact with those at risk. However, do assist them by ordering or delivering their shopping for them, or in any way that minimizes their exposure to potential sources of infection.

Avoid touching your face

Your mouth, nose, and eyes are easy pathways for the virus to transfer from your hands to inside your body. Even between sessions of hand-washing, it is important to remember not to touch your face. You may be unaware of certain gestures, either when touching objects or when touching your face, so this is a type of learned behavior that we all need to pay attention to.

Do not rush to the ER

If you do feel unwell, it is important to not rush out to a clinic or hospital. Please call the emergency services and follow their instructions. Rushing out in case of infection can be detrimental to your health and the health of other people you will be exposing. Bear in mind that, in most cases, the symptoms of COVID-19 are mild (fever and coughing being the most common) and there is no cause to panic.

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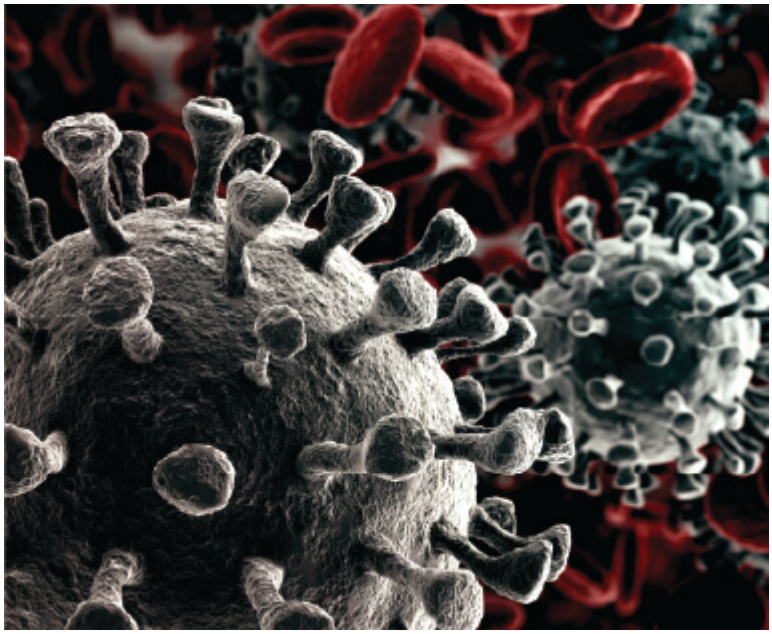
8 ways COVID-19 might impact your business



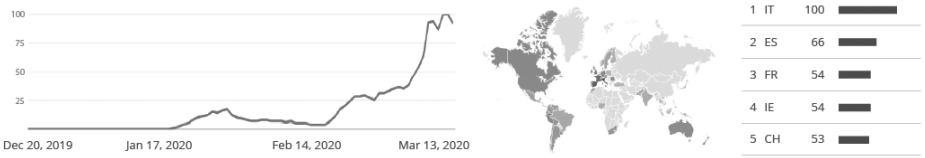
*by **Ilinca Anghelescu**, EW Nutrition*

By now there is no doubt the economic impact of COVID-19 will be massive. The question is, how exactly will the pandemic impact your business – and what can you do to mitigate or prevent what's coming?

Since January, the international community has been aware of the seriousness and ease of contagion of COVID-19. Despite that, internet searches for "coronavirus" only exploded over the past couple of weeks. Worldwide, as a population, we were more interested in Harry Styles, home loan rates and Gal Gadot than in the impending crisis.

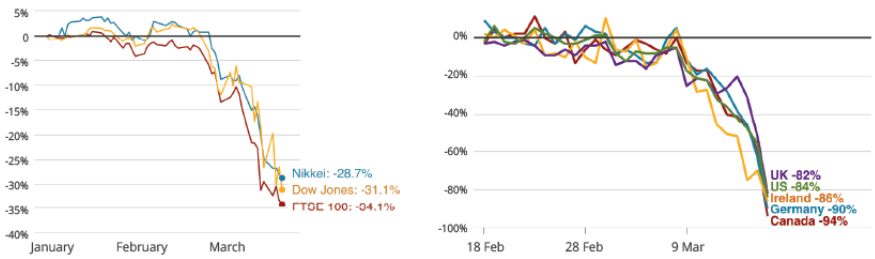
In other words, we individually, as well as markets, were slow to understand and accept the long-term implications of the pandemic.

Google searches for "Coronavirus" since December and which countries did it most



Now that the seriousness of the pandemic has hit home, there are known losses in some industries: airlines worldwide are expected to lose $29BN, with some smaller players being forced out of business by reduced demand. Other low-margin industries, like restaurants or the travel industry, are likewise already sustaining major losses.

Figure 1 – Visualization of COVID-19 impact on markets / Restaurant reservations



And while we are seeing the world slowly understanding and adapting to a new reality, you, like everyone

else, have to prepare for the impact of COVID-19 on your business. *Quick note:* though it may appear so at first, not all the ways the pandemic affects businesses are negative!

Labor shortage

As workers are affected by the pandemic, many will either choose to stay home or will be forced to. In some countries, self-isolation measures are elective. In other regions that are more severely affected, the government may require workers in non-essential industries to not break isolation measures. This may affect your company at all levels, from processing feed or feeding animals to delivering goods across quarantined regions.

What you can do:
– Identify proximity workers you can rely on
– Preemptively create crisis scenarios for a reduced workforce
– Create a waiting list of short-term labor resources

Supply shortages

Lockdowns in China, Italy or Spain already provide examples of what happens when regions go into full isolation. Consider how massive shortages in the antibiotic supply from China or shipment delays across the world, for instance, are already affecting the animal production industry.

What you can do:
– Overstock now
– Contact alternative suppliers to create an improved supply chain
– Check expiration dates for your existing supply and consume early dates first
– Choose alternatives for products with an uncertain supply chain

Demand shortages

Depending on the industry and the market, you may be faced with reduced demand. Simply consider the fact that reduced demand for restaurants will lower, in turn, demand for supplies for the restaurant: less meat, butter, milk consumed in restaurants is less meat ordered.

What you can do:
– Prepare for basic production only

– Prepare to stock raw materials long-term if possible
– Discuss with suppliers to cut or minimize deliveries

Government policies

The Food and Drug Administration, the United States' highest authority in food and medicine safety, announced it would suspend inspections of foreign food manufacturers. The impact of this decision could be felt in the quality of foreign feed or raw materials quality. Other governments are already – or might soon be – limiting imports, restricting non-essential activities, offering financial packages for at-risk businesses,

What you can do:
– Review government policy updates on a daily basis and tailor production and operations to ensure compliance
– Give early feedback to government measures
– Apply early for relief measures, even if not severely impacted yet

Lower biosecurity standards

Even now, biosecurity is implemented more in theory than in practice. Routinely there are small infringements – and we can expect their numbers to grow massively in times of crisis. People are less likely to go through the motions if personnel is reduced, supervision is less strict, and the financial pressure of the pandemic is high. This will trigger severe risks for the animal and feed production industries, as well as for product packaging. Workers who hide symptoms to be able to sustain wages; workers attempting to speed up work because of reduced personnel; reduced or looser inspections and monitoring – all these could perpetrate risks to your operations and to the population at large.

What you can do:
– Tighten biosecurity measures and controls
– Supplement lower government monitoring with additional on-location measures
– If you operate with a reduced workforce, periodically check how downscaling affects biosecurity implementation

Immediate economic downturn

At this point, almost all industries have a global component: your raw materials may be imported; the ingredients in the antibiotics or vaccines you use may come from anywhere around the world; your packaging may be produced in China; your software solutions may come from the Indian subcontinent; your quality controls may be managed by a consultancy from a distant European country – and so on. However much we may try to avoid it, there may be immediate repercussions on your business. Either because your goods may be inaccessible for part of the world, because of lower demand on the consumer side, or because of diminished production capacities, you may feel the impact of the pandemic sooner rather than later.

What you can do:
– Cut costs for non-essentials
– If you are in feed production, consider stocking on toxin binders, search for alternative suppliers, and assess your supply levels
– If you are in livestock production, employ solutions for animal health and welfare to lower disease risk
– Apply for government bailout early
– Assess your export strategy and prepare to zoom in on domestic
– Assess long-term payroll capacities during diminished business demand

Changing consumption trends

It turns out that, after all, the impact could be positive for some industries. The meat industry seems to be doing relatively well, despite the challenges. While in China, severely affected by ASF on the animal side and now by COVID-19 on the human side, meat production was dramatically affected, in other regions demand for – and supply of – animal protein is stable. Consider the new opportunities for frozen or prepackaged food products: as less fresh meat is consumed in restaurants or bought because of infrequent store visits, consumption of these meat products and by-products is not expected to go down – in fact, it may well increase.

The market might, however, first have to be taught to embrace these prepackaged or frozen products.

What you can do:
– Prepare for less fresh meat demand by upping prepackaged meat production
– Teach your end-users about the benefits of frozen products, from meat to egg whites, for instance

Negative impact for others, positive impact for you

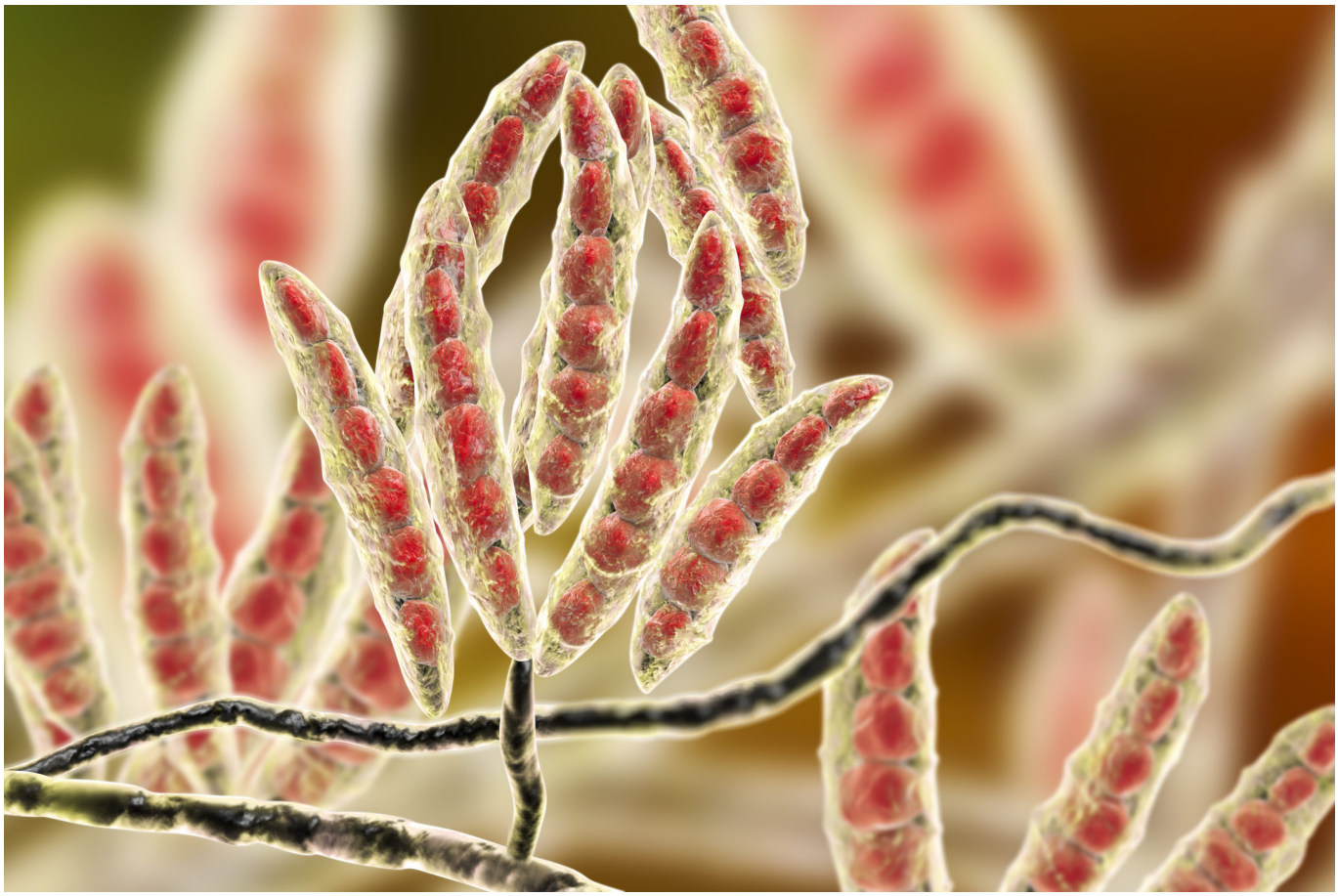
While the negative effects are real, there are ways you can balance the COVID-19 impact by taking advantage of some of the positives. Consider that, to give just one example, the energy market is likely going to take a hit. This, in turn, may lead to lower fuel costs for farmers.

Reduced travel means more savings for your company, and while working from home (WFH) may lead in some cases to somewhat reduced productivity, taking an early stand and instructing your team on how to structure WFH days will help preserve productivity while cutting down on energy, fuel and other travel costs, cleaning, in-office equipment depreciation, and other such expenses.

What you can do:
– Check your balance sheets regularly
– Transfer savings from quick benefits into investments into long-term strategy
– Most importantly – never panic!

Ongoing research into treating COVID-19 already shows great promise. While we do not yet know how long these unusual circumstances will last, you can make provisions for the near future and think long-term of how to protect your businesses from this pandemic or any future such challenges.

A complex battlefield: mycotoxins in the gastrointestinal tract



Most grains used as feed raw materials are susceptible to mycotoxin contamination. These toxic secondary metabolites are produced by fungi before or after harvest and cause severe economic losses all along agricultural value chains. For livestock, negative consequences include acute effects such as impaired liver and kidney function, vomiting, or anorexia, as well as chronic effects such as immunosuppression, growth retardation, and reproductive problems. Mycotoxin management is, therefore, of the utmost priority for animal producers worldwide.

But how is it that mycotoxins cause such damage in the first place? This article delves into the complex processes that take place when mycotoxins come into contact with the gastrointestinal tract (GIT). The intestinal epithelium is the first tissue to be exposed to mycotoxins, and often at higher concentrations than other tissues. A deeper understanding of how mycotoxins affect the GIT allows us to appreciate the cascading effects on animal health and performance, why such damage already occurs at contamination levels well below official safety thresholds – and what we can do about it.

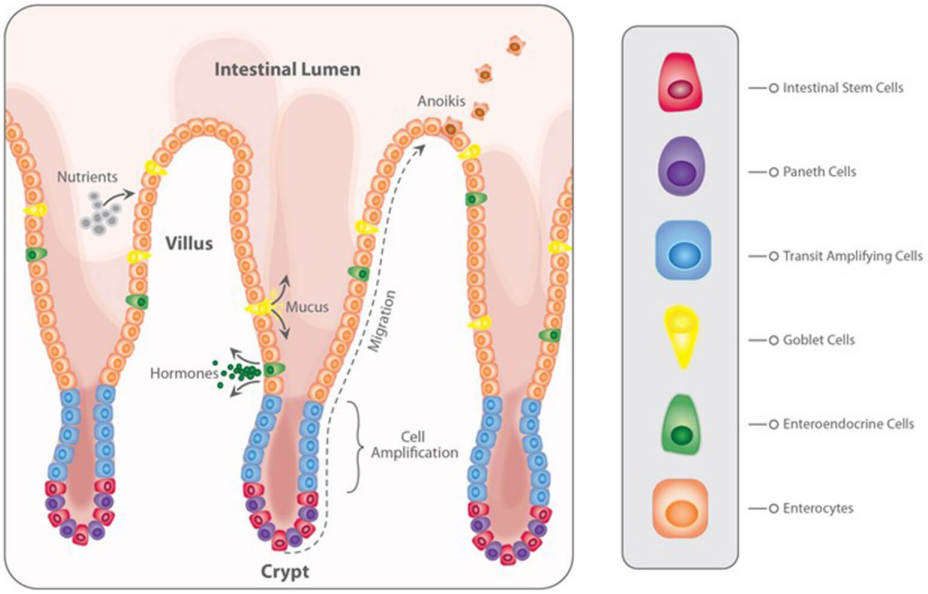
The intestinal epithelium: the busy triage site for nutrients and harmful substances

When mycotoxins are ingested, they encounter the GIT's intestinal epithelium (Figure 1). This single layer of cells lining the intestinal lumen serves two conflicting functions: firstly, it must be permeable enough to allow the absorption of nutrients. On the other hand, it constitutes the primary physiological barrier against harmful agents such as viruses, microorganisms, and toxins.

Within the intestinal epithelium, several types of highly specialized cells are involved in epithelial regeneration, nutrient absorption, innate defense, transport of immunoglobulins, and immune surveillance. The selective barrier function is maintained due to the formation of complex networks of proteins that link adjacent cells and seal the intercellular space. Besides, the intestinal epithelium is covered with mucus produced by goblet cells, which isolates its surface, preventing the adhesion of pathogens to the enterocytes (intestinal absorptive cells).

Due to its dual involvement in digestive and immune processes, the intestinal epithelium plays a pivotal role in the animal's overall health. Importantly, the epithelium is directly exposed to the entire load of ingested mycotoxins. Hence their effects can be problematic even at low concentrations.

Figure 1: The intestinal epithelium



Problematic effects of mycotoxins on the intestinal epithelium

Most mycotoxins are absorbed in the proximal part of the gastrointestinal tract (Table 1). This absorption can be high, as in the case of aflatoxins (~90%), but also very limited, as in the case of fumonisins (<1%); moreover, it depends on the species. Importantly, a significant portion of unabsorbed toxins remains within the lumen of the gastrointestinal tract.

Some of the mycotoxins that enter the intestinal lumen can be bio-transformed into less toxic compounds by the action of certain bacteria. This action, however, predominantly happens in the large intestine – therefore, no detoxification takes place before absorption in the upper parts of the GIT. Part of the absorbed mycotoxins can also re-enter the intestine, reaching the cells from the basolateral side via the bloodstream. Furthermore, they re-enter through enterohepatic circulation (the circulation of substances between the liver and small intestine). Both actions increase the gastrointestinal tract's overall exposure to the toxins.

Table 1: Rate and absorption sites of different mycotoxins

Mycotoxin	Primary absorption sites	Absorption rate in poultry	Absorption rate in swine	Observations
Aflatoxin	Duodenum / Jejunum	~90%	~80%	Subject to enterohepatic circulation
DON	Duodenum / Jejunum	Up to 20%	Up to 60%	Subject to enterohepatic circulation and to biotransformation in the large intestine
Fumonisin	Duodenum / Jejunum	Less than 1%	Less than 5%	Subject to enterohepatic circulation
Ochratoxin	Jejunum	~40%	~60%	Subject to enterohepatic circulation and to biotransformation in the large intestine
Zearalenone	Small & large intestine	~10%	~80%	Subject to enterohepatic circulation

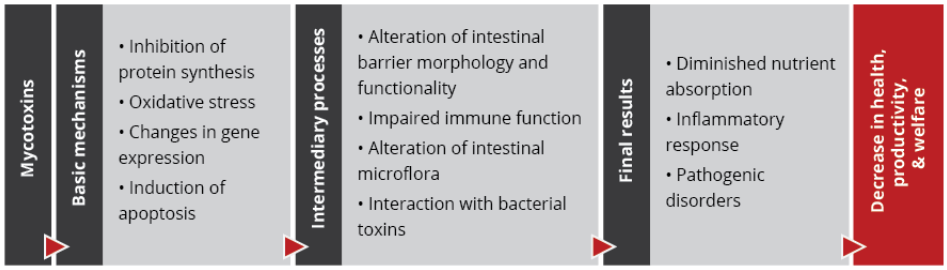
Adapted from: Biehl et al., 1993; Bouhet & Oswald, 2007; Devreese et al., 2015; Ringot et al., 2006

The damaging impact of mycotoxins on the intestinal epithelium initially occurs through:

- A decrease in protein synthesis, which reduces barrier and immune function (Van de Walle et al., 2010)
- Increased oxidative stress at the cellular level, which leads to lipid peroxidation, affecting cell membranes (Da Silva et al., 2018)
- Changes in gene expression and the production of chemical messengers (cytokines), with effects on the immune system and cellular growth and differentiation (Ghareeb et al., 2015)
- The induction of programmed cell death (apoptosis), affecting the reposition of immune and absorptive cells (Obremski & Poniatowska-Broniek, 2015)

Importantly, studies based on realistic mycotoxin challenges (e.g., Burel et al., 2013) show that the mycotoxin levels necessary to trigger these processes are lower than the levels reported as safe by EFSA, the Food Safety Agency of the European Union. The ultimate consequences range from diminished nutrient absorption to inflammatory responses and pathogenic disorders in the animal (Figure 2).

Figure 2: Mycotoxins' impact on the GIT and consequences for monogastric animals



1. Alteration of the intestinal barrier's morphology and functionality

The mycotoxins DON, fumonisin, and T2 induce a reduction in the rate of epithelial cell proliferation and differentiation. This causes a decrease in the height and the surface of the intestinal villi, which in turn leads to a reduction in nutrient absorption. Additionally, some nutrient transporters are inhibited by the action of mycotoxins such as DON and T2, for example, negatively affecting the transport of glucose.

Several studies indicate that mycotoxins such as aflatoxin B1, DON, fumonisin B1, ochratoxin A, and T2, can increase the permeability of the intestinal epithelium of poultry and swine (e.g. Pinton & Oswald, 2014). This is mostly a consequence of the inhibition of protein synthesis. As a result, there is an increase

in the passage of antigens into the bloodstream (e.g., bacteria, viruses, and toxins). This increases the animal's susceptibility to infectious enteric diseases. Moreover, the damage that mycotoxins cause to the intestinal barrier entails that they are also being absorbed at a higher rate.

2. Impaired immune function in the intestine

The intestine is a very active immune site, where several immuno-regulatory mechanisms simultaneously defend the body from harmful agents. Immune cells are affected by mycotoxins through the initiation of apoptosis, the inhibition or stimulation of cytokines, and the induction of oxidative stress. Studies demonstrate that aflatoxin, DON, fumonisin, T2, and zearalenone interact with the intestinal immune system in such a manner that the animal's susceptibility to viral and bacterial infections increases (e.g., Burel et al., 2013). Moreover, by increasing their fecal elimination, the horizontal transmission of pathogens is extended.

For poultry production, one of the most severe enteric problems of bacterial origin is necrotic enteritis, which is caused by *Clostridium perfringens* toxins. Any agent capable of disrupting the gastrointestinal epithelium – e.g. mycotoxins such as DON, T2, and ochratoxin – promotes the development of necrotic enteritis. The inhibition of the intestinal immune system caused by mycotoxins such as aflatoxin, DON, and T2 also collaborates with the development of this disease.

3. Alteration of the intestinal microflora

The gastrointestinal tract is home to a diverse community of bacteria, fungi, protozoa, and viruses, which lines the walls of the distal part of the intestine. This microbiota prevents the growth of pathogenic bacteria through competitive exclusion and the secretion of natural antimicrobial compounds, volatile fatty acids, and organic acids.

Recent studies on the effect of various mycotoxins on the intestinal microbiota show that DON and other trichothecenes favor the colonization of coliform bacteria in pigs. DON and ochratoxin A also induce a greater invasion of *Salmonella* and their translocation to the bloodstream and vital organs in birds and pigs – even at non-cytotoxic concentrations. It is known that fumonisin B1 may induce changes in the balance of sphingolipids at the cellular level, including for gastrointestinal cells. This facilitates the adhesion of pathogenic bacteria, increases in their populations, and prolongs infections, as has been shown for the case of *E. coli*.

From the perspective of human health, the colonization of the intestine of food-producing animals by pathogenic strains of *E. coli* and *Salmonella* is of particular concern. Mycotoxin exposure may well increase the transmission of these pathogens, posing a risk for human health.

4. Interaction with bacterial toxins

When mycotoxins induce changes in the intestinal microbiota, this can lead to an increase in the endotoxin concentration in the intestinal lumen. Endotoxins or lipopolysaccharides (LPS) are fragments of Gram-negative bacteria's cell walls. They are released during bacterial cell death, growth, and division. Hence endotoxins are always present in the intestine, even in healthy animals. Endotoxins promote the release of several cytokines that induce an enhanced immune response, causing inflammation, thus reducing feed consumption and animal performance, damage to vital organs, sepsis, and death of the animals in some cases.

The synergy between mycotoxins and endotoxins can result in an overstimulation of the immune system. The interaction between endotoxins and estrogenic agents such as zearalenone, for example, generates chronic inflammation and autoimmune disorders because immune cells have estrogen receptors, which are stimulated by the mycotoxin. The combination of DON at low concentrations and endotoxins in the intestine, on the other hand, has been shown to engender a decrease in transepithelial resistance and to alter the balance of the microbiota.

What to do? Proactive toxin risk management

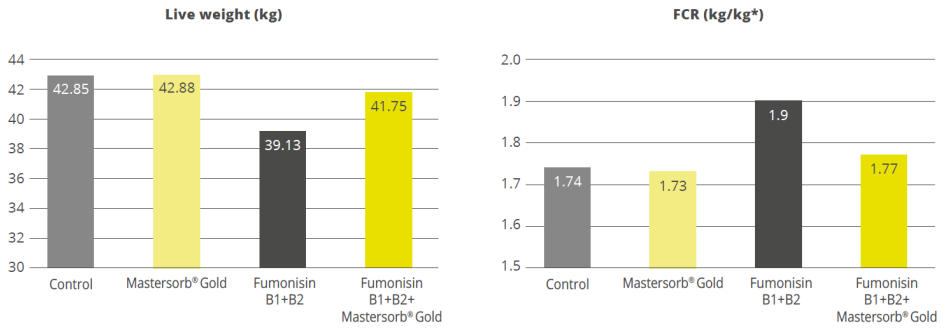
To prevent the detrimental consequences of mycotoxins on animal health and performance, proactive solutions are needed that support the intestinal epithelium's digestive and immune functionality and help maintain a balanced microbiome in the GIT. Moreover, it is crucial for any anti-mycotoxin product to feature both anti-mycotoxin and anti-bacterial toxin properties and that it supports the organs most targeted by mycotoxins, e.g., the liver. EW Nutrition's Mastersorb Gold premix is based on the synergistic combination of natural clay minerals, yeast cell walls, and phytomolecules. Its efficacy has been extensively tested, including as a means for dealing with *E. coli* endotoxins.

Mastersorb Gold: anti-mycotoxin activity stabilizes performance and strengthens liver health

A field trial conducted in Germany on male Ross 308 broilers showed that for broilers receiving a diet contaminated with DON and zearalenone, adding 1kg of Mastersorb Gold per ton of feed to their diet led to significant performance enhancements. Not only did they recuperate the mycotoxin-induced weight loss (6% increase relative to the group receiving only the challenge), but they gained weight relative to the control group (which received neither the challenge nor Mastersorb Gold). Feed conversion also improved by 3% relative to the group challenged with mycotoxins.

A scientific study of crossbred female pigs showed that Mastersorb Gold significantly reduced the deleterious effects of fumonisin contamination in the feed. The decrease in weight gain and the decline of feed conversion could be mitigated by 6.7% and 13 FCR points, respectively (Figure 3). Also, the sphinganine/sphingosine (Sa/So) ratio, a biomarker for fumonisin presence in the blood serum, could be decreased by 22.5%.

Figure 3: Mastersorb Gold boosts performance for pigs fed a fumonisin-contaminated diet

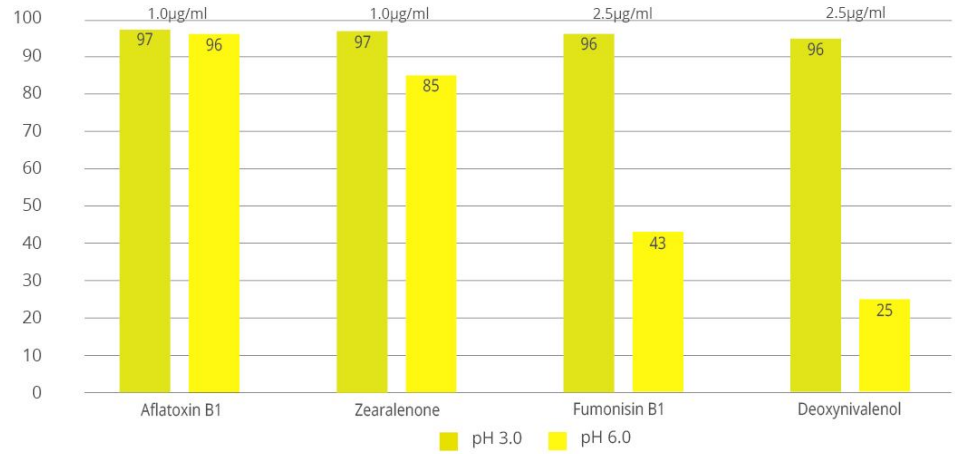


Another study of crossbred female piglets, carried out at a German university, investigated whether Mastersorb Gold could support performance as well as liver health under a naturally occurring challenge of ZEA (~ 370ppb) and DON (~ 5000ppb). Mastersorb Gold significantly improved weight gain and feed conversion in piglets receiving the mycotoxin-contaminated diet: daily body weight gain was 75g higher than that of a group receiving only the challenge, and the FCR improved by 24% (1.7 vs. 2.25 for the group without Mastersorb Gold). Moreover, Mastersorb Gold significantly improved the liver weight (total and relative) and the piglets' AST levels (aspartate aminotransferase, an enzyme indicating liver damage). A tendency to improve spleen weight and GGT levels (gamma-glutamyl transferase, another enzyme indicative of liver issues) was also evident, all of which indicate that Mastersorb Gold effectively counteracts the harmful impact of mycotoxin contamination on liver functionality.

In-vitro studies demonstrate Mastersorb Gold's effectiveness against mycotoxins as well as bacterial toxins

Animal feed is often contaminated with two or more mycotoxins, making it important for an anti-mycotoxin agent to be effective against a wide range of different mycotoxins. Besides, to prevent mycotoxins damaging the GIT, an effective product should ideally adsorb most mycotoxins in the first part of the animal's intestine (under acidic conditions). In-vitro experiments at an independent research facility in Brazil showed that an application of 0.2% Mastersorb Gold binds all tested mycotoxins at rates from 95 to 97% at a pH level of 3, using realistic challenges of 1000ppb (Aflatoxin B1 and ZEA) and 2500ppb (Fumonisin B1 and DON). The binding results achieved for Fumonisin and DON, which are often considered outright "nonbinding," under challenging close to neutral conditions (pH 6), are particularly encouraging.

Figure 4: Mastersorb Gold binding capacity against different mycotoxins (%)



Concerning its efficacy against endotoxins, an *in vitro* study conducted at Utrecht University, among other studies, has shown Mastersorb Gold to be a strong tool against the LPS released by *E. coli.* For the test, four premium mycotoxin binders were suspended in a phosphate buffer solution to concentrations of 0.25% and 1%. *E. coli* LPS were suspended to a final concentration in each sample of 50ng/ml. Against this particularly high challenge, Mastersorb Gold achieved a binding rate of 75% at an inclusion rate of 1%: clearly outperforming competing products, which at best showed a binding rate of 10%.

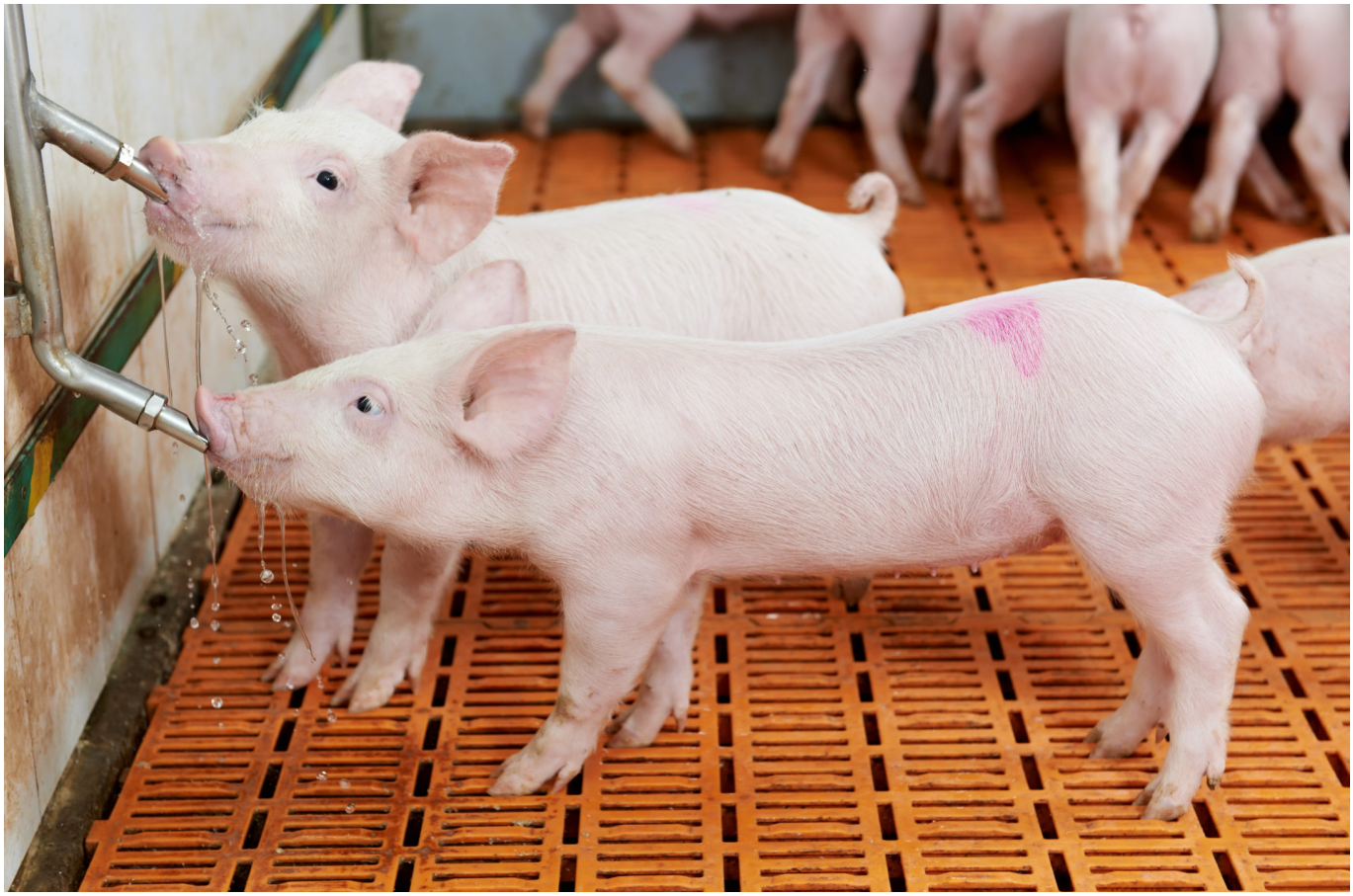
Conclusion

A healthy gastrointestinal tract is crucial to animals' overall health: it ensures that nutrients are optimally absorbed, it provides effective protection against pathogens through its immune function, and it is key to maintaining a well-balanced microflora. Even at levels considered safe by the European Union, mycotoxins can compromise different intestinal functions such as absorption, permeability, immunity, and microbiota balance, resulting in lower productivity and susceptibility to disease.

To safeguard animal performance, it is important to continually strive for low levels of contamination in feed raw materials – and to stop the unavoidable mycotoxin loads from damaging the intestinal epithelium through the use of an effective anti-mycotoxin agent, which also supports animals against endotoxins and boosts liver function. Research shows that Mastersorb Gold is a powerful tool for proactive producers seeking stronger animal health, welfare, and productivity.

By Marisabel Caballero, Global Technical Manager Poultry, EW Nutrition

5 key facts pig producers need to know about the EU’s ZnO ban



We all know the headlines, “European Commission adopts ZnO ban” or “Zinc oxide to be phased out at EU level by 2022”. Clearly, EU legislation has far-reaching consequences for European pig producers – but in the jungle of acronyms and legalistic jargon, it’s not always clear which institution gets to decide what and why. Here are five key facts that help pig producers make sense of the EU’s zinc oxide ban.

1. Zinc oxide can only be used as a feed additive (low dosage)

Pigs require zinc to maintain various metabolic functions, hence it is included in their diet as a feed additive. This use will not be banned: ZnO is included as a source of zinc in the so-called register of feed additives, which applies to the whole EU. The European Commission decides which products are included in the register based on the opinions of the European Food Safety Authority (EFSA), which also advises the Commission on topics like animal welfare and African swine fever. The EFSA currently suggests that a total level of 150ppm meets the animals’ physiological needs for zinc. The European Commission has turned this recommendation into law, hence 150ppm is the legal limit for zinc supplementation for piglets.

2. The EU sets common rules for veterinary medicinal products

ZnO-based products to treat post-weaning diarrhea in piglets, on the other hand, contain pharmacological doses of zinc oxide. A commonly administered dosage is 100mg per kg body weight per day for 14 consecutive days, amounting to 2500ppm zinc in the feed. These products are classified as veterinary medicinal products (VMPs) and are thus covered by Directive 2001/82/EC on medicinal products for veterinary use and by Regulation (EC) No 726/2004. These pieces of legislation set out the EU's rules for the production, distribution, and authorizations of VMPs, and they establish the European Medicines Agency (EMA). Just as the EFSA advises the European Commission on feed additives, they turn to the EMA regarding VMPs.

What is the difference between a "regulation" and a "directive"?

Regulations automatically apply to all EU countries, without needing to be transposed into national law. A directive requires EU members to achieve certain objectives – and to transpose them into national law – but lets them to choose how to do so, as long as they meet a set deadline.

Zinc oxide – two different uses, two different situations

	ZnO as a feed additive	ZnO as a veterinary medicinal product (VMP)
EU agency	European Food Safety Authority (EFSA)	European Medicines Agency (EMA)
Legislation	Regulation (EC) No 1831/2003 on additives for use in animal nutrition	Directive 2001/82/EC on veterinary medicinal products + Regulation (EC) No 726/2004 Note: by 2022 these two will be replaced by the new Regulation (EU) 2019/6
Levels	Max. total 150ppm of zinc (from ZnO and other sources)	Normal dosage ca. 2500ppm
Ban?	No! There is no indication at the moment that zinc oxide will be banned as a feed additive.	**Yes!** Marketing authorizations for VMPs containing zinc oxide will be withdrawn the across EU by June 2022.

3. ZnO products licenses are a national topic – but subject to EU scrutiny

One of EMA's key topics are marketing authorizations: VMPs can only be sold and traded in the EU if they have received a marketing authorization, which is basically a license. Depending on the type of VMP and on when it was first released, the marketing authorization is either issued by the EMA or by national authorities. Veterinary medicines containing zinc oxide are (or rather were) within the remit of national authorization procedures. However, national authorities are supposed to turn to the EMA's Committee for

Medicinal Products for Veterinary Use (CVMP) if they have any issues with an application that is submitted to them. This is what happened in the case of zinc oxide.

4. France and the Netherlands initiated the review of zinc oxide

A European company in the feed industry had applied for marketing authorization for its ZnO-based medicated feeding stuff for piglets in the United Kingdom, hoping for a so-called decentralized authorization procedure to take place. This procedure would mean that the marketing authorization issued in the UK would also be valid in other EU countries. However, France and the Netherlands objected to this on the grounds of environmental concerns. Initially, the CVMP ruled that the marketing authorization could be granted, but France and the Netherlands persisted. In a second round, they raised doubts about the efficacy of risk mitigation measures and the added issue of antimicrobial resistance. This time, they were successful.

5. Bottom line: ZnO products will no longer get a marketing authorization

In March 2017, the CVMP concluded that zinc oxide's benefits of preventing diarrhea do not outweigh the risks to the environment. Therefore the panel recommended that national authorities withdraw existing marketing authorizations for zinc oxide-based VMPs and that they no longer grant new authorizations. Shortly after that, on 26 June 2017, the European Commission adopted the CVMP's recommendation, which means that all EU countries have to implement it. This decision also says that countries may defer withdrawing the marketing authorizations if they think that the lack of available alternatives and necessary changes in farming practices put too much pressure on their pig sectors. They can only defer for five years though; hence, the decision must be implemented no later than 26 June 2022.

How do you say "ZnO ban" in EU terms?

The withdrawal of marketing authorizations for veterinary medicinal products containing zinc oxide to be administered orally to food-producing species.

Today we stand at the half-way point before the ban of VMP ZnO as a veterinary medicinal product kicks in across the EU. Hence the search is on for effective strategies to control post-weaning diarrhea: without zinc but through continuous improvements in management and feed practices, as well as the support of targeted, functional feed additives.

By Technical Team, EW Nutrition
Article available in german, dutch and spanish.

EW Nutrition Launches Top-Performing Bacterial Xylanase Enzyme

Press Release – In December 2019, EW Nutrition has officially launched Axxess XY, a novel, intrinsically thermostable xylanase enzyme that delivers top performance to feed producers and the livestock industry. The revolutionary product was launched at a customer-centric circuit event across five locations in India.

In its effort to improve animal gut health, control toxin risk, and reduce antibiotic use, EW Nutrition has long supported the Indian livestock industry with its holistic, science-backed solutions. The company is now entering a highly competitive market with a revolutionary solution: Axxess XY. This enzyme comes with the highest level of intrinsic thermostability and is active against both soluble and insoluble arabinoxylans. The top benefit of Axxess XY is an unparalleled flexibility in feed formulation, resulting in significant feed cost savings.

The mechanisms and derived profits of the new product were discussed during a five-city customer-centric event titled “GURU SPEAKS”, part of EW Nutrition’s “Partners in Progress” series. The key speaker was Dr. Craig Nelson Coon, Head of the Department of Poultry Sciences at the University of Arkansas, USA. Dr. Coon has over 50 years’ experience in research and teaching in poultry science.

Dr. Shirish Nigam, Managing Director of EW Nutrition South Asia, and Dr. Ajay Awati, Global Category Manager, Enzymes, highlighted Axxess XY’s unique value proposition and shared various trials conducted to prove the competitive advantage over other enzymes available in the market.

Dr. S. Mahendran, Regional Technical Manager, South Asia threw light on feed formulation optimization and explained how the addition of Axxess XY can help release additional energy from feed, which results in optimum performance and production.

The unparalleled thermostability of Axxess XY became a talking point among the audience and various integrators showed their interest in using the new enzyme in their formulations. Also, EW Nutrition’s efforts to bring everyone together on a knowledge-sharing platform was highly applauded by the attendees. Industry partners also iterated the need for more detailed sessions in the future.

The “GURU SPEAKS” series was a great opportunity to reach a wider array of breeders and broiler

integrators across India. The event was kickstarted on 16th December, 2019 at Karnal, followed by Coimbatore, Hyderabad, Pune, and Bangalore. Prof. Coon shared relevant and practical solutions to the common challenges faced by broilers and broiler breeders. He also shared his insights on nutrition and management of modern broiler breeders and highlighted that maintaining the protein balance is nowadays gaining more importance than energy requirements for better production and performance of birds. He deliberated on the pros and cons of current feeding practices and management, including biosecurity and lighting schedules for birds.

Major key stakeholders – technical consultants, university professors, farm managers, integrators, etc. – attended the series and benefitted from the information provided during the event.

“We are pleased to bring our revolutionary enzyme solution to our Indian partners, thus enriching our portfolio of products and services to the benefit of the local livestock industry,” says Michael Gerrits, Managing Director, EW Nutrition. “We are confident that Axxess XY will be a breakthrough for our customers, and we look forward to providing and servicing our comprehensive animal nutrition solutions in India, a most valuable and respected market.”

About EW Nutrition
EW Nutrition is an international animal nutrition company that offers integrators, feed producers, and self-mixing farmers comprehensive animal nutrition solutions for gut health, antibiotic reduction, young animal nutrition, toxin risk management and more.

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