Issue 19 • Poultry
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Science & Solutions

Tomorrow's flocks

The importance of day old chick quality

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Fumonisins REVEALED

Effects in poultry

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What's wrong with my birds?

Part 4: Egg production/quality

Editorial

New and familiar challenges

The last quarter of 2014 and early 2015 saw the re-emergence of *highly pathogenic avian influenza* (HPAI) throughout the Northern Hemisphere from Korea and China in the east, westwards in Russia, Germany, Holland, the UK and also across the Atlantic to Canada and the US. In Europe this lead some to question whether free-range layer flocks should temporarily be kept inside to reduce contamination risk from wild bird populations.

Better biosecurity is one way to prevent diseases entering the farm environment and can contribute to a reduction in antibiotic usage—a goal now gaining strength throughout the world.

One of the main reasons for antibiotic usage in poultry production is to prevent mortality in the first 2 weeks of life. Improving the health status of the day old chick is therefore of prime importance. In this issue of **Science & Solutions** we explore ways of enhancing chick quality from the breeder to the broiler farm.

Last harvest also saw a dramatic rise in the mycotoxin contamination of corn (maize), leading some Southern and Eastern European governments to issue warnings to the feed and livestock industries. Given the prominence of corn in poultry diets, this year's high levels of deoxynivalenol, zearalenone and fumonisins is worrying. In this issue we highlight fresh research on the latter —often considered the main mycotoxin in corn—showing fumonisins' potential to harm poultry and an innovative way to combat them.

Finally, this issue brings the fourth part of our series on differential diagnosis covering egg production and quality issues.

Andrew ROBERTSON
Poultry Technical Manager

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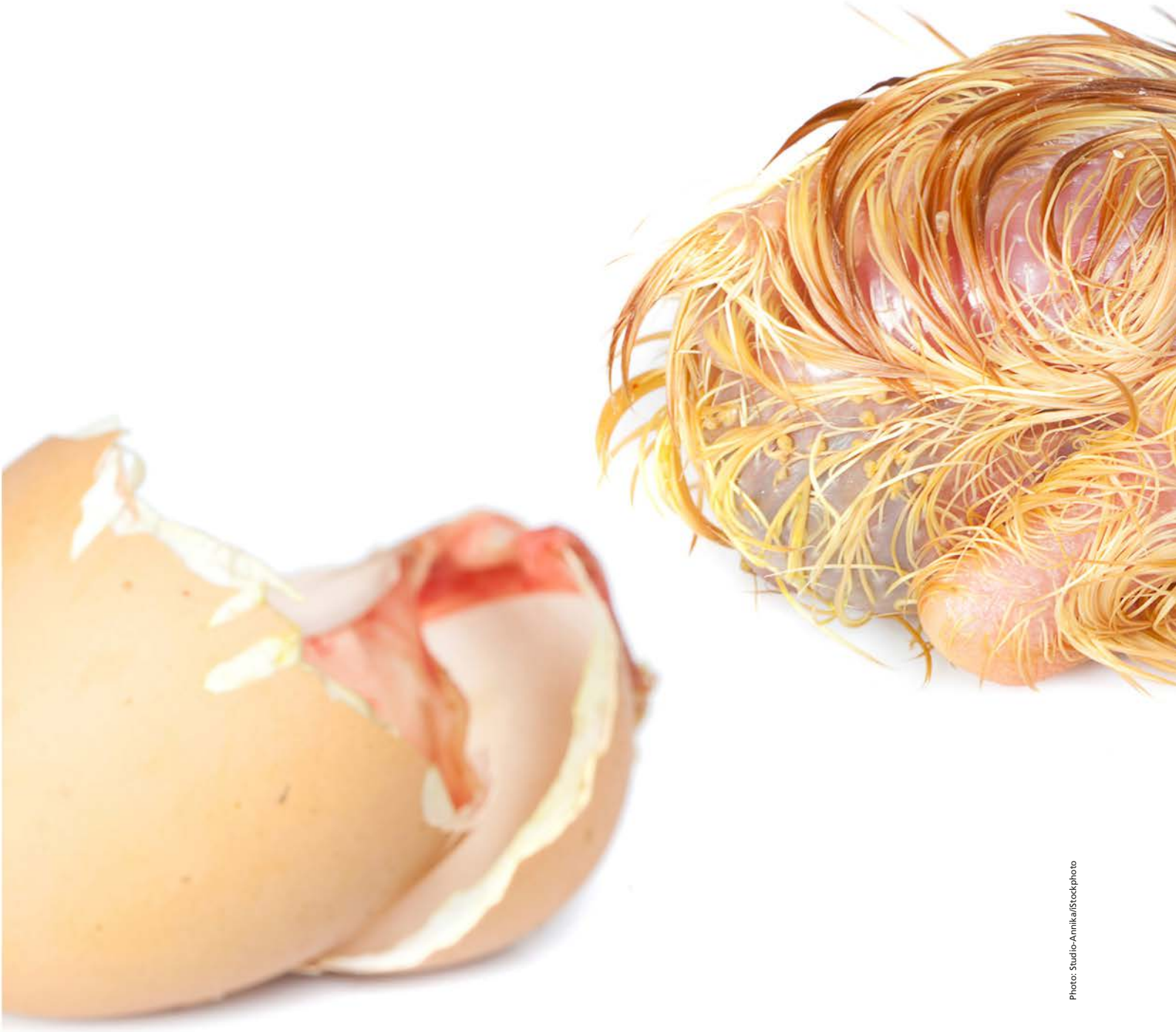
The Importance of Day Old Chick



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Quality

By **Fernando Trajano Lima** - Poultry Technical Manager

A 1-day old chick has the potential to become a broiler chicken, a layer or breeder. Given this versatility, the quality of day old chicks (DOCs) matters immensely to poultry businesses. This article addresses key development stages, focusing on most frequent disturbances in the field and relevant solutions.

Mycotoxin contamination can in some cases be vertically transmitted, negatively impacting embryo development and thus future flock growth.

Healthy chicks are the starting point for good poultry performance. Yet, any number of problems — some difficult to detect early on — can impact the quality of day old chicks. From the breeder's farm to the hatchery and transportation to final farm reception, management practices have a real impact. Optimized processes and preventive measures can give chicks the right start.

Handle with care

At the hatchery, attention to hatchery process is vital to avoid poor chick quality. Special care should be taken for long time storage, separating small eggs from bigger eggs by donor flock age, hatchery hygiene and transportation conditions. Long storage can reduce hatchability, impairing the animal's future growth rate. Separation of chicks coming from young and older breeder flocks will improve homogeneity. Yolk sac infection and aspergillosis can be linked to hatchery hygiene, but also to the cleanliness of the egg.

Get the bugs out

At hatch some chicks are already contaminated with bacteria that can lead to high mortality from yolk sac infection or bacterial chondronecrosis with osteomyelitis (BCO). As young chicks develop, fast growth of the birds can produce microscopic cracks in the cartilage of the femoral head. Opportunistic bacteria can move from the digestive tract to the blood system and finally to inflamed areas such as these. If not caught and addressed in a timely manner, it becomes considerably more difficult and costly to control these pathogens. One field trial held in Holland showed that day old chicks infected with *Enterococcus* later developed BCO due to an earlier infection in the circulatory system. Solutions that counteract bacteria at early stages of this journey can be effective.

Species-specific probiotics, for example, can deter the attachment of opportunistic bacteria to the intestine receptors and thus limit infection. Trial results comparing the effectiveness of probiotics to antibiotics show that probiotics significantly reduce instances of BCO lameness while improving feed efficiency and final body weight.

Smart shopping

Buying day-old chicks from a reputable hatchery company and providing them a clean, warm place to grow with easy access to clean fresh water and good-quality chick feed will generally result in healthy chicks.
However, heterogeneity, omphalitis and other bacterial infections that could affect normal growth of the chick may only exhibit after a few days. Seven-day mortality can offer a rough guide to brood health.

Pathogens, a poor inheritance

Vertical transmission of bacteria (from mother to her offspring) can negatively impact chicks' health and resistance to diseases, with further consequences in terms of growth and livability. It is important to control Gram-negative bacteria such as *Salmonella* and *E. coli* and Gram-positive ones such as *Enterococcus* and other aggressive agents at all stages.

Gram-negative bacteria in particular spread easily from breeder houses to hatcheries and day old chicks, leading to high mortality and costly antibiotic treatments that are best avoided.

Generally, bacteria control starts with breeder house management using a proper vaccination program and controlling water and feed hygiene. Disinfection of eggs right after laying and rejection of dirty eggs further reduces the risk of contamination.

Feed and water

Pathogens can also contaminate feed and water. Feed and water hygiene thus play an important role in breeder house management to prevent bacterial contamination

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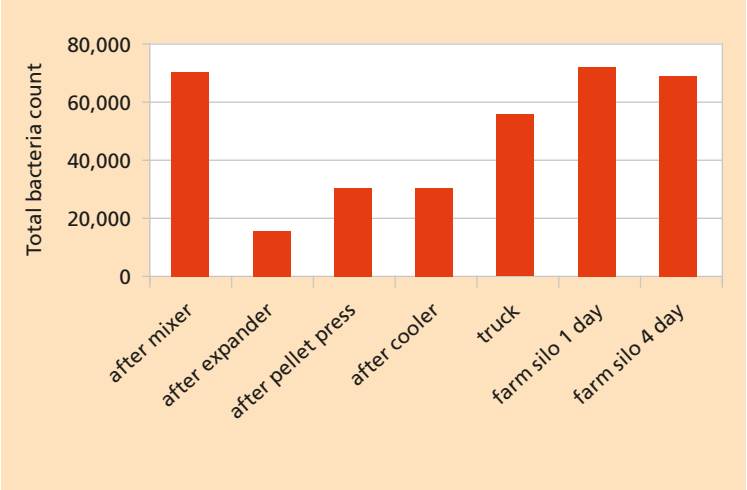
Poultry Technical Manager

passing from breeders to eggs and chicks. A combined organic acids plus permeabilizer solution weakens the outer membrane of Gram-negative bacteria and kills microbes—thus protecting the host animal.

It is important to check all raw materials, especially cereals and protein sources, for *Salmonella* contamination. While heat treatment of feed is a common method to control bacteria, it does not guard against recontamination during transportation and storage. As shown in *Figure 1*, the bacterial count of feed rebounds in the hours and days after treatment.

Because *Salmonella* can persist in contaminated drinking water systems for several weeks, it is advised to use acidifiers in animal's drinking water in addition to chlorination or other measures in order to preserve hygienic quality. A combination organic acids and chlorinated water enhances hypochlorous acid levels, having strong disinfectant and antioxidant effects.

Figure 1. Recontamination of feed without acidifier



Source: Israelsen et al.*, 1996*

Gut health

Non-starch polysaccharides (NSPs) are anti-nutritional compounds in the feed that increase the viscosity of the gut content, resulting in greater bacteria proliferation and sticky droppings—thus increasing the number of dirty and contaminated eggs. Enzymes that breakdown NSPs may offer one possible solution. Phytogenics also support gut performance: certain plant-derived substances are proven to decrease microbial overload, improve nutrient digestibility, boost animal performance and improve egg shell quality.

Mycotoxin contamination

The occurrence of mycotoxins — toxic fungal metabolites found in raw materials and feedstuffs — has increased in recent years and poses a threat to livestock production globally. Some mycotoxins hamper the immune system's response to vaccines, weakening animals' defenses. Others interact synergistically with pathogens, having compound negative effects on animal health and performance. Mycotoxin contamination can in some cases be vertically transmitted, negatively impacting embryo development and thus future flock growth.

Given the numerous harmful effects of mycotoxins on poultry, preventive feed application measures are strongly recommended in breeders and in broilers alike. Fortunately, Mycofix® effectively combats not just for adsorbable mycotoxins but also non-adsorbable ones using enzymatic biotransformation to convert them into non-toxic metabolites.

Conclusion

Ensuring day old chick quality puts chicks on the right path to good health and performance. Pathogens and mycotoxin contamination –whether via ingestion or vertical transmission– can cause real harm whose effects multiply in the presence of both.

Modern management practices that support strong gut performance and mycotoxin risk management are the foundation for success in all stages of poultry production.

Know your enemy – **Fumonisins**

by **Sabine Masching** - Product Manager and **Bertrand Grenier** - Researcher

Fumonisins, a group of harmful, toxic fungal metabolites, are a major contaminant of corn (maize). From the 1970s to the late 1990s fumonisins were not considered a major threat to the poultry industry. Intensive scientific research over the last 15 years has revealed alarming ways that fumonisins interact with birds' immune and digestive system. From this better understanding a novel approach to minimizing the risk to poultry has emerged.

Fumonisin prevalence

Globally, the predominant grain used in poultry feeds is corn (maize). As the occurrence of fumonisins is ubiquitous and not limited to a specific climate, these toxic substances constitute a worldwide phenomenon. The latest BIOMIN Mycotoxin Survey results show that 73 percent of 1,071 corn samples analyzed tested positive for fumonisin contamination with an average of positives of 2,914 parts per billion, or ppb. The second largest group in this survey comprised finished feed with 63 percent of 1,676 samples analyzed testing positive for fumonisins with an average contamination of 926 ppb. Soybean, wheat and other grains showed a lower presence of fumonisins compared to corn (*Table 1*).

REVEALED

What We Know about Fumonisins in Poultry

Unexpected, uncommon conditions

Serious risk of immune and digestive problems

Occassional, unfavorable weather conditions

Moderate risk of immune and digestive problems

Realistic, common field conditions

Some risk of immune and digestive problems

High

Fumonisin exposure

Low

Table 1. Fumonisin occurrence by commodity

	Corn	Soybean	Wheat	Other Grains	Finished Feed
Samples tested	1,071	160	208	191	1,676
Positive samples [%]	73	23	15	40	63
Maximum contamination [ppb]	154,000	977	4,333	37,515	25,041
Average contamination of positive samples [ppb]	2,914	123	433	1,526	926

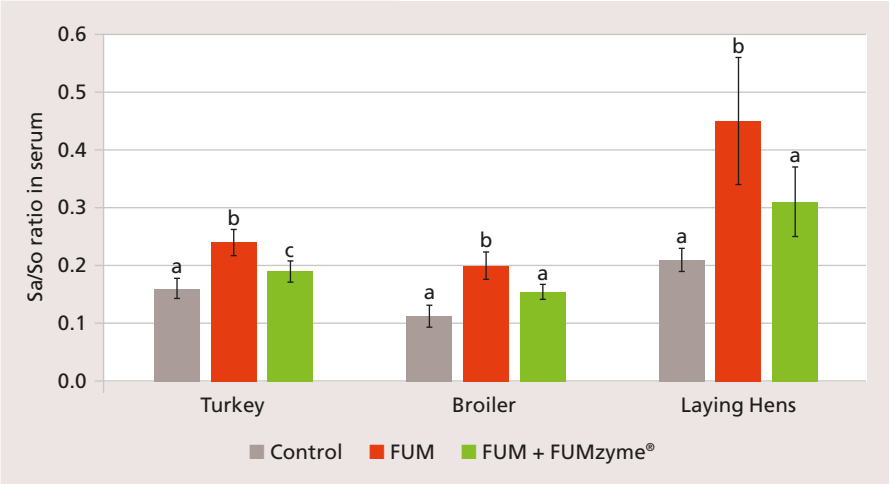
Source: 2014 BIOMIN Mycotoxin Survey

Understanding fumonisins' effects in poultry

Cutting-edge technologies allowing for more finely-tuned analysis of mycotoxins and their impacts on animals account for recent evidence that fumonisins occurring at subclinical concentrations predispose birds to metabolic and immunologic disorders.

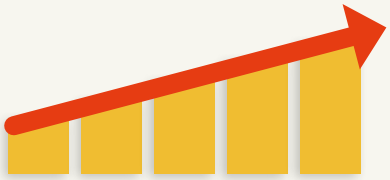
Recent data showed that the ingestion

Figure 2. Effect of fumonisins and FUMzyme® on biomarkers (Sa/So ratio) in serum of different poultry species



[a, b, c] ....different letters indicate statistically significant differences (P<0.05)

Scource: BIOMIN

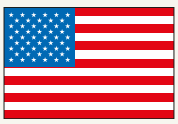


The **Sa/So ratio** increases as fumonisin levels rise, making it a good **biomarker of exposure**

Maximum recommendation for fumonisins in finished feed:

EU
20 ppm

USA
50 ppm



of 10 ppm fumonisins affected the expression of proteins related to pro- and anti-inflammatory responses in the intestinal tract of broiler chickens (Grenier *et al.*, 2014). At a concentration of 20 ppm, the limit set by the EU for poultry, fumonisins induce higher excretion of Eimeria strains, parasites responsible for coccidiosis (Grenier *et al.*, 2015). Considering the high density of birds in large-scale operations, the ingestion of contaminated feed with fumonisins may promote parasite transmission between birds. A separate experiment using similar concentrations reported an effect on proteins in chickens' intestines involved in drug metabolism that could alter the effectiveness of some drugs (Antonissen *et al.*, 2014). Altogether, these recent findings suggest that the intestinal tract of birds is very sensitive to fumonisin exposure.

Inside the bird

Fumonisins block the synthesis of complex sphingolipids that play an important role in protecting nerves, muscles and membranes. As a consequence, the free sphingoid bases sphinganine (Sa) and sphingosine (So), both highly toxic to most cells, accumulate in tissues leading to severe cell damage and cell death. Based on this, the sphinganine-sphingosine ratio (Sa/So) is used as a biomarker for fumonisin exposure, an increase indicates a negative impact of fumonsins on the animal. This ratio is routinely assessed in blood or liver.

Combating the challenge

The most effective way to counteract fumonisins is via enzymatic biotransformation, the highly specific and irreversible conversion of mycotoxins into non-toxic metabolites. FUMzyme®, the first purified enzyme converts fumonisins into non-toxic hydrolyzed FB_1 (HFB_1). Scientific studies demonstrate that HFB_1 does not cause intestinal or hepatic toxicity and does not induce major changes in the sphingolipid metabolism (Grenier *et al.*, 2012).

The fumonisin biomarker Sa/So ratio is very sensitive and dose-dependent. In several *in vivo* studies with poultry the efficacy of FUMzyme® was investigated further assessing the Sa/So ratio as benchmark for reducing fumonisin exposure in animals (*Figure 2*). In these studies, poultry species were fed diets contaminated with fumonisins: the feed contained 5 ppm for turkeys, 10 ppm for broiler chickens and 16 ppm fumonisins for laying hens. In all these studies, the addition of FUMzyme® effectively reduced the Sa/So level in serum of the birds (P<0.05).

Conclusion

Fumonisins are prevalent worldwide. For a long time poultry have been suggested to be less susceptible to fumonisins lacking clinical signs of impairment even with high contamination levels. Recent findings focusing on subclinical effects of fumonisins suggest that the intestinal tract of birds is very sensitive to the exposure to fumonisins.

Results of scientific studies in different poultry species indicate that fumonisins indeed represent a major risk to animal health. Effective mycotoxin risk management including novel approaches to biotransformation is essential to help the animal to face fumonisin-induced impairment of the immune and digestive system.

Cut & Keep Checklist

What's wrong with my birds? Part 4: Egg production/quality problems

Good, stable egg production and good quality are of utmost importance. Bad management practices, feed and environment-related issues and diseases are some of the factors which may negatively impact egg production and egg quality.

Also animal-related factors, such as age and strain of layer birds, must not be disregarded. Older birds and birds after molting are known to produce bigger eggs with thinner shells and indigenous strains cannot quite compete with commercial layers in terms of number of eggs produced.

Several management issues (see table) may lead to nervous birds and/or traumatic lesions in the ovary which cause poor egg quality (fragile shell/bloodspots/meat spots). Nutrition-wise, improper balance of calcium, phosphorus and vitamin D may lead to thin egg shells. Also large amounts of Lucerne/alfalfa meal in diet can lead to blood spots caused by vitamin K antagonists in this feed ingredient. Interestingly, the use of the drug sulphaquinoxaline may have the same effect as mineral imbalance. In terms of pathogens, Infectious Bronchitis (IB) causes respiratory disease and kidney damage in growers and oviduct infection in adult hens which can cause wrinkled egg shells as well as a reduction in eggs laid.

Due to the liver and kidney toxicity mycotoxins may negatively impact egg and shell formation, leading to poor egg and shell quality (pale eggs/small, fragile shell/bloodspots/meat spots). For mycotoxin-related problems, prevention can be undertaken through the use of a proper mycotoxin risk management tool which adsorbs and/or biotransforms mycotoxins, thus eliminating their toxic effects for the animals, while guaranteeing liver and immune protection. The Mycofix® product line from BIOMIN combines the three strategies – adsorption, biotransformation and bioprotection – which work together to prevent the hazardous effects of mycotoxins in poultry flocks.

Check list	Corrective action
Potential cause: MANAGEMENT: Nervous birds/traumatic lesions in the ovary	
• Lighting program • Temperature of the barn • Presence of frights and disturbances in the barn that may get birds nervous	• Correct lighting program • Correct temperature of the barn • Improve management of laying birds
Potential cause: MYCOTOXINS: Aflatoxins (Afla), Cyclopiazonic acid (CPA), T-2 toxin (T-2), Ochratoxin A (OTA)	
• Positive for Afla, CPA, T-2 and/or OTA in raw materials (ELISA) or feed (HPLC) • Raw materials originating from supplier/region with history of mycotoxin contamination • Histopathology: Check other target organ (e.g. kidneys, liver) for mycotoxins • Decline in overall flock performance	• Check average contamination levels • Use Mycofix® at the correct dosage level • Avoid feed bins or feed/water lines to become contaminated by stale, wet or mouldy feed
Potential cause: NUTRITION: Mineral/vitamin imbalance	
• Calcium/phosphorus balance in diets • Calcium carbonate particle size	• Correct mineral and vitamin balance • Correct calcium carbonate particle size
Potential cause: NUTRITION: Vitamin K antagonists	
• Content of lucerne/alfalfa meal in diets • Presence of sulphaquinoxaline in diets	• Correct amount of lucerne/alfalfa meal in diets • Correct medication program
Potential cause: PATHOGENS: Infectious bronchitis (IB)	
• Laboratory tests to confirm the presence of the coronavirus in a swab or tissue sample	• Vaccination program must be adapted to the demands of the field situation in each particular area/epidemiology
Potential cause: GENETICS: Bird strain	
• Check with genetic supplies (some strains more susceptible to blood spots)	• Replace genetics if necessary

References are available on request

For more information, visit **www.mycotoxins.info**

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