Mycotoxins: an invisible problem in your hatchery

Low hatchability, reduced egg quality and impaired chick immunity are common hatchery challenges. Mycotoxins could be the culprit. Mycotoxins are unavoidable contaminants in feed that have toxic effects on bird health.

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They are highly present in poultry diets worldwide, but due to their often-invisible effects, mycotoxins are frequently overlooked in parent stock farms, with the negative outcomes appearing at the hatcheries.

Mycotoxins can negatively impact a diversity of indices that are necessary for the success of breeder and hatchery production: fertility, eggshell quality, efficiency of vaccine response and quality of the progeny.

Becoming informed and aware of this challenge and how to protect your birds is key to helping them reach their maximum genetic potential and, consequently, maximising the economic success of your hatchery.

Are there mycotoxins in your poultry feed?

The DSM World Mycotoxin Survey has been measuring contamination levels in feed for nearly two decades, and has found that 98% of poultry feed samples are contaminated by mycotoxins. Moreover, 86% are positive for more than one mycotoxin, which means the toxic effects can be potentialised inside the bird's organism and have even more harmful effects. In poultry, for instance, there is frequent co-contamination with deoxynivalenol (DON) and fumonisins (FUM).

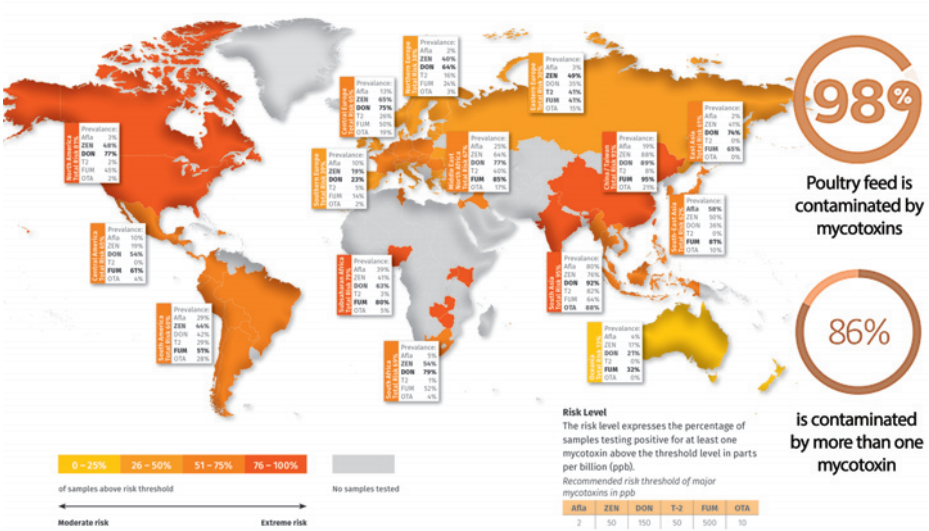
When both mycotoxins are involved in degradation of the tight junctions, their effect is considered synergistic – that is, the total effects are greater than the simple sum of each individual effect – and can lead to severe cases of 'leaky gut'.

Although many regions have an overall risk that is considered medium/high, each region has a different mycotoxin contamination profile based on which specific mycotoxins are present, in which combinations and in what amounts. Fig. 1 shows the six mycotoxins that cause the most harm in birds.

DON and FUM are the most prevalent worldwide, and are related to gut health issues and immunosuppression. Zearalenone (ZEN) is also commonly found and impacts the fertility and egg production of breeders and layers.

Aflatoxin (Afla) affects liver functionality and the immune system and, although toxin T2 (T2) and ochratoxin (OTA) are less prevalent, their toxic effects can be acute even at low dosages.

Fig. 1. The worldwide presence of mycotoxins in poultry.



How mycotoxins impact chicks' incubation and hatch

Mycotoxins negatively impact a diversity of indices connected to the performance of breeders and their chicks and consequently affect economic indices such as:

- Impaired performance of breeders and roosters:

ZEN has a similar chemical structure to the hormone oestrogen, and is usually related to reproductive disorders. The presence of ZEN in breeder diets can modify the physiology of the reproductive tract by inducing hyperactivity of the ovaries and cystic oviducts.

These alterations reflect in lower fertility rates, egg production and hatchability of eggs. OTA is another mycotoxin that alters embryo development, decreasing chick livability and reducing the progeny's ability to fight infections.

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● **Reduced egg quality:**
Mycotoxins such as T2, OTA and ZEN influence eggshell formation through different modes of action: reduced calcium absorption, changes in the protein synthesis and/or modification of the reproductive physiology in such a way that breeders and layers are not able to produce high-quality eggs.

Lower quality eggs result in fewer eggs hatching, reducing the hatchery's overall production output. Measurements that quantify the changes in egg quality due to mycotoxins include: reduced Haugh units, height of the albumen and egg weight, as well as reduced eggshell thickness and alterations in egg size.

● **Impaired yolk formation and reduced chick livability:**
The liver is responsible for lipid metabolism, which is directly correlated with the yolk formation and formation of liposoluble vitamins. The most common pathological lesions associated with mycotoxicosis in poultry are found in the liver.

When liver function of the breeder hen is impaired, there is a direct link to impaired yolk formation. Since the yolk is a key component in the nutrition and health of a developing chick, this results in higher initial chick mortality.

● **Predisposition to 'leaky gut' and contamination through the hatchery:**
DON and FUM have a large impact on gut integrity.

They influence the formation and functionality of tight junctions, a multi-protein complex established between closely connected intestinal cells that maintains a barrier between the gut lumen and the blood circulation. Both mycotoxins contribute to increased permeability causing 'leaky gut' syndrome.

As a result, the proliferation of intestinal pathogens, for example Salmonella sp, may also be increased. Moreover, liquid excreta lead to a higher percentage of dirty eggs, which reduces the overall hygienic status of the hatchery.

● **Impaired immunity and vaccine failure:**
Even at moderate levels of contamination, mycotoxins are considered immuno-suppressive agents and are capable of downregulating antibodies and immunoglobulins synthesis. These mechanisms are attributed to mycotoxins including AFLA, trichothecenes, FUM and OTA.

Their presence can be considered a driver of failure in vaccine programmes. Several studies have shown that Fusarium mycotoxins such as DON reduce antibody titers for Newcastle disease and the infectious bronchitis virus in breeders.

How to avoid this risk in the hatchery

An integrated, three-step mycotoxin risk management system is key to protecting your birds from mycotoxins and maximising your hatchery's ability to produce viable progeny.

● Identify the mycotoxins present in your poultry feed using reference methodologies such as HPLC MS/MS.

● Once you know which mycotoxins are present, provide the right counteraction solution to protect the birds.

Be aware that certain deactivation strategies are not effective for all mycotoxins.

For instance, common binders, such as aluminosilicates, are only effective for adsorbable mycotoxins like AFLA.

Other mycotoxins such as FUM, DON, ZEN, OTA and T2 are considered non-adsorbable and can only be controlled through biotransformation, which breaks the toxic part of their chemical structure.

Only precise biological compounds and enzymes are able to perform these specific reactions and guarantee the production of non-toxic and environmentally safe metabolites.

● Utilise bioprotection. Biotransformation utilises selected plant extract to support the functionality of target mycotoxins organs such as the liver and gut. ■