How mycotoxins threaten bird health and performance

Mycotoxins are metabolites produced by moulds during times of stress or following an environmental stimulus. These moulds can grow on crops in the field or even on stored feedstuffs and feed materials post-harvest.

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The poultry industry continues to learn more and more about the impacts of mycotoxins on bird health and performance.

Often, livestock and poultry feedstuffs can be contaminated with multiple mycotoxins because many moulds grow under similar conditions, producing different mycotoxins.

In the field, mycotoxins can develop due to a variety of circumstances, with environmental conditions playing the largest role. Moulds can produce mycotoxins at a variety of temperatures and after either wet or drought conditions, depending on the mould species. They may also be stimulated by a sudden change in environmental conditions, such as a freeze-thaw cycle.

In storage, moulds often produce mycotoxins in spots with excess moisture or high oxygen penetration.

There are hundreds of mycotoxins that these moulds can produce, and the most common mycotoxins are produced by moulds from the Fusarium, Aspergillus and Penicillium genera.

Any commodity may be contaminated by mycotoxins. Corn and corn products are the most frequently contaminated, but wheat, barley and oats can also contain significant levels of mycotoxins.

Even soybean meal and other plant-based proteins can be affected.

Alternative feedstuffs, such as dried distiller's grains, corn or wheat-gluten byproducts, can be more cost-effective. However, they may present a higher risk of mycotoxin contamination due to the concentration of these products. For example, dried distiller's grains can have, on average, three times the amount of mycotoxin contamination as a raw corn source.

Multiple-mycotoxin contamination can occur in finished feeds because it is a mixture of a variety of grains from many sources. Whether stored in a silo or a feed bin, further mycotoxin contamination may occur if the conditions foster mould growth and stress.

Within the bin, there may be 'hot spots' or areas of increased mould growth or stress. This type of mycotoxin contamination can occur on top of what has already happened in the field.

Once mycotoxins are formed, they are very stable and will remain in a feedstuff throughout harvest, storage, feed processing and feeding.

Why should we care about mycotoxins in birds?

A common myth in poultry production is that mycotoxin issues are only found in long-lived poultry, such as layers and breeders, and are not a problem in short-lived poultry, like broilers. While mycotoxin contamination can build up over time, and, in so doing, affect longer-lived birds, short-term exposure can also be detrimental to shorter-lived birds.

Subclinical mycotoxicosis, caused by short-term exposure or exposure to low levels of mycotoxins, is thought to be a common occurrence in poultry production, but diagnosis can be difficult.

Sensitivity to mycotoxins in poultry can vary based on the mycotoxin type and/or the bird's age, health status or species, but mycotoxins have been shown to influence bird health and performance. Mycotoxin contamination in finished feeds, whether mash or pellet, may occur at low-, medium- or high-challenge levels.

In the same finished feed, it is possible for different mycotoxins to be present at multiple challenge levels that could impact various aspects of the bird's health. Realistically, low- to medium-level challenges may be found in finished feeds and, at these doses, the immune system and predisposing factors to other intestinal challenges are often impacted, even when performance does not appear to be impaired.

Another common myth is that mycotoxins appear alone when contaminating a grain. In actuality, several mould types can contaminate a single grain, and several mycotoxin families can be present at once.

Additionally, animal feed often contains a mixture of grains and ingredients, which means that there may be several different types of mycotoxins present in finished feed.

Research shows that when multiple different mycotoxins are consumed, the impact on the bird can increase.

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The impact of mycotoxins on poultry health

The gastrointestinal tract of the bird, from the beak to the cloaca, is the first organ to encounter mycotoxin contamination in the feed. Generally, mycotoxins impair the rapidly dividing cells found in many places within the body, including the gastrointestinal tract.

Aflatoxins, type A trichothecenes (for example, T-2 toxin), type B trichothecenes (for example, DON), fumonisins, ochratoxins and ergot toxins all impact the gastrointestinal tract in various ways, including mouth lesions, damaged intestinal integrity, reduced feed intake, reduced nutrient absorption, immunosuppression and wet manure.

Ergot toxins are often found in grains that grow in cooler climates, such as wheat, barley and oats. Ergot toxicity increases with grain processes like pelleting. Ergotism leads to reduced blood flow to the extremities, including the comb or feet, and has also been associated with decreased feed intake, reduced growth, lower egg production, damage to the intestinal structure and diarrhoea.

Poultry are sensitive to ochratoxins. Ochratoxins contaminate corn and most small grains but can also be found in byproducts, such as bakery meal. Ochratoxins readily form when the temperature and moisture levels are high. In poultry feed, these mycotoxins are more common in certain parts of the world, like Europe, and are less common in North America.

In general, contamination with ochratoxins can lead to a variety of issues, including a reduction in weight gain, intestinal inflammation, diarrhoea, intestinal fragility and, in some cases, feed refusal. Often, a classic sign of ochratoxin toxicity is kidney damage marked with increased levels of uric acid.

In breeders and layers, these toxins can impact sexual maturity and can decrease egg production, egg quality and immune protection in offspring chicks. In instances of low-to-medium contamination, liver and kidney weight could increase and immune function might decrease, which could lead to poor responses to vaccination and an increased susceptibility to other diseases.

Aflatoxins are one of the better-known mycotoxins. Compared to other poultry species, ducks and turkeys are most susceptible to aflatoxins; however, aflatoxin contamination can affect all poultry. In general, aflatoxins impair liver, kidney and pancreas function. The impairment of liver and kidney function can happen with low or high levels or with long-term contamination.

These functional effects can lead to a decrease in weight gain, feed intake, feed conversion and reproductive function. Aflatoxins can also decrease iron absorption and interact with nutrients like riboflavin and vitamin D. Some researchers have suggested that aflatoxin contamination might also impair nutrient digestion in the small intestine and decrease the bird's ability to protect itself from stressors.

Advancements in mycotoxin detection technologies are equipping poultry producers with more effective tools to control mycotoxins.

Fusarium mycotoxins such as trichothecenes, fumonosins (FUM) and zearalenone (ZEA) can all negatively impact the gastrointestinal tract. The trichothecenes group contains mycotoxins like deoxynivalenol (DON) and T-2/HT-2 toxins. Studies have demonstrated how the presence of T2 toxins can lead to reduced feed consumption, growth depression, oral lesions and a decrease in egg production.

DON decreases nutrient uptake and intestinal cell integrity and increases the nutrients available for certain bacterial growth (for example, Clostridium perfringens, which causes necrotic enteritis), as well as gut permeability, allowing nutrients to leak outside of the intestines in all poultry.

FUM has been linked to black adhesive diarrhoea in layers and mucous diarrhoea in other poultry species. In general, these mycotoxins can suppress the immune system, which increases the risk of secondary diseases, bacterial or viral, and potentially impacts feed efficiency, weight gain, egg production and other performance parameters.

Although these toxins can cause extensive damage on their own, they seem to cause even more damage when found in combination. For instance, when feed is contaminated with DON, T-2 and ZEA, birds exhibit decreased immune protection in the gut, increased intestinal cell damage and decreased intestinal cell growth.

DON and ZEA together can impair the intestinal recovery of birds infected with coccidiosis. DON and FUM together can increase intestinal permeability – the ability of organisms/contaminants to cross the intestinal barrier – and alter the microbial communities in the gastrointestinal tract of the bird.

Monitoring for mycotoxins

It is important to watch birds closely on-farm and to be on the lookout for signs of mycotoxicosis. However, it is also crucial to remember that these signs can be both specific and nonspecific, making it necessary to use an appropriate method to evaluate the mycotoxin contamination of the feed. Risk can vary with feed type, as some grains, feeds, byproducts or finished feeds will be at higher risk than others.

Several mycotoxin detection strategies, varying in cost, sensitivity and accuracy, are available. A lateral flow test such as Alltech Rapiread is a quick and easy way to screen grains for certain mycotoxins. Although this method is not as sensitive as other methods, it is a rapid, inexpensive way to get a better idea which mycotoxins may be present in the individual raw materials.

The gold-standard method is liquid chromatography-tandem mass spectrometry (LC-MS/MS), offered by Alltech 37+. This high-tech method can screen for multiple mycotoxins simultaneously in grains and in finished feeds. While this strategy is more expensive than other methods, it is the most sensitive and accurate method of assessing mycotoxin contamination.

If mycotoxins are detected in the grains or the feed, it is important to use different approaches – from diluting the contaminated grain to using broad-spectrum mycotoxin binders – at both the farm and the feed mill. Mycotoxin contamination can be managed, but a combination approach from field to farm must be taken. ■

References are available from the author on request