Mycotoxins: a serious threat to breeder flocks

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The occurrence of mycotoxins is ubiquitous, which is why it represents a worldwide problem for the animal industry. Even with the use of prevention techniques in the field or during storage, it is actually impossible to avoid mycotoxins completely in agricultural commodities.

Thanks to modern analytical methods and growing interest in this field of research, more than 400 different mycotoxins have currently been identified. The toxicity of different mycotoxins brings serious risks to humans and animals. Mycotoxicoses are animal or human diseases caused by mycotoxin ingestion, inhalation or skin-contact.

In animals, these range from immunosuppression and performance effects to hepatotoxic, nephrotoxic, neurotoxic, dermal, carcinogenic, reproductive, teratogenic and gastro-intestinal effects depending on animal, environmental and toxin related factors. The effects of mycotoxins in poultry depend upon the age, physiological state and nutritional status of the birds at time of exposure.

Unfortunately, mycotoxins often occur in low concentrations that are difficult to detect, interactions between individual mycotoxins are not well characterised and unidentified mycotoxins may be causing sub-optimal performance.

Nowadays, the poultry industry gives a lot of importance to cost management at all steps of production. In broilers, the production of hatching eggs or day-old chicks does not represent a high proportion of the overall cost of production per kg of bird slaughtered.

Nevertheless, the performance of broiler breeders is looked at with a lot of attention, and the number of saleable chicks per hen is always focused on. The quality of day-old chicks and especially its influence on the improvement of their performance is a bit neglected. In general, the way that parental nutrition impacts the subsequent broiler and layer performance is poorly studied: most of the time, egg fertility and hatchability are emphasised more.

Difficult diagnosis

It is not easy to detect or diagnose problems related to mycotoxins as their effects in poultry are diverse, varying from immunosuppression to death in severe cases, depending on toxin-related (type of mycotoxin consumed, level and duration of intake), animal-related (species, sex, age, breed, general health, immune status, nutritional standing) and environmental (farm management, hygiene, temperature) factors.

In the field, birds are exposed to a wide range of mycotoxins and are subject to a broad variety of stressing factors. They may be in poor health conditions, fragile immune and antioxidant status as well as subjected to problematic management practices.

All these factors contribute a great deal to the final susceptibility of animals in the presence of mycotoxins. So, it is not surprising if birds exhibit mycotoxicoses even at apparent 'low levels' of mycotoxins present in the feed.

Table 1. Effects of mycotoxins during the critical periods in the life of a breeder.

Key stages	Development	Effects of mycotoxins
Critical period one (0-6 weeks)	Massive intestinal development	Reduced feed intake and inhibition of protein synthesis reducing structure growth.
	Development of the active immune system	Immunosuppression. Increased risks and more difficult therapies to infection.
	Start of the vaccination programme	Reduced vaccine efficacy leading to lower titer levels. Reduced coccidiostat efficacy.
Critical period two (14/15-18/20 weeks)	Testis development	Zearalenone shown to reduce testis growth. Cysts in testes.
	Ovary development	Cysts in ovaries. Early maturity.
	Calcium metabolism	Interference in vitamin D metabolism reducing calcium transport.
Critical period three (19/20-35/40 weeks)	Early laying period	Haemorrhagic ovaries. Reduced egg production. Reduced egg quality. Cessation of egg production.
	Mating stress	Immune suppression leading to increased infections.
	Growth	Reduced feed intake limiting nutrient availability, thereby reducing egg production and growth.

Invisible losses

Acute mycotoxicoses outbreaks are rare events in modern poultry production. However, low mycotoxin doses, which very often are not detected, are responsible for reduced efficiency of production and increased susceptibility to infectious diseases.

Nonetheless, a more likely scenario is to find mycotoxins at lower levels interacting with other stressors leading to subclinical losses in performance, increases in incidence of disease and reduced reproductive performance.

To the poultry producer these subclinical losses are of greater economic importance than losses from acute effects, but again, even more difficult to diagnose.

Clinical effects in poultry

Poultry are farm animal species sensitive to mycotoxins as they suffer several toxic effects. Broiler chickens are more resistant to aflatoxins than other poultry like ducks, geese or turkeys.

Predominately, aflatoxins are the most immune suppressive, carcinogenic and hepatotoxic. Aflatoxins decrease feed intake, decrease daily weight gain leading to

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decreased slaughtering weight and egg production. Aflatoxins impair health of breeding birds and may cause inhomogeneous flocks and can cause decreased hatchability of eggs.

Type A trichothecenes (T2 toxin, HT2 toxin, diacetoxyscripenol) are of major concern to poultry industries and cause economic losses in productivity. They are highly toxic for poultry, especially for chickens, because they have very low LD50 values (2mg/kg for diacetoxyscirpenol and 4mg/kg for T2 toxin).

T2 toxin, particularly, reduces feed intake, body weight, egg production and causes oral and gizzard lesions.

Young chicks and turkey poults are highly sensitive to ochratoxins.

These nephrotoxins can suppress feed intake, growth, egg production and additionally causes poor egg shell quality. Fumonisins are associated with spiking mortality in poultry.

Signs of dietary fumonisin are decreased body weight and average daily weight gain as well as increased gizzard weights.

In comparison to other species like pigs, poultry are less affected by zearalenone (ZON) and also appear to be less sensitive to type B trichothecenes such as deoxynivalenol (DON). However ZON can have a negative effect on both fertility and hatch of fertile eggs.

Ergot alkaloids may induce neurotoxic effects as reduced feed intake, while birds are reluctant to move and may be suffering from respiratory difficulties. Birds affected by ergot alkaloids have lower performance including poor growth and decreased egg production. Most obvious pathological changes are gangrenous lesions on toes, beaks and claws.

Carry-over of mycotoxins

Scientific reports mention that feeding diets contaminated with mycotoxins (DON, ZON) increased the percentage of non-viable germs and increased early and late embryonic mortality associated with reduced eggshell thickness.

Fusarium toxins in naturally contaminated oats increased embryonic developmental anomalies and delayed ossification.

Moreover, it was reported that hatchability was reduced due to embryonic mortality, being confirmed the teratogenicity of OTA.

Afla accumulates in the genitals of chickens, turkeys and ducks, resulting in a transfer to the egg (albumen and yolk) as well as to their offspring (yolk sac and liver). When high T-2 toxin doses get into the egg, the eggs will appear infertile.

At lower toxin contamination embryonic development will start but the embryo will die at a later stage of development, presenting blood-spots. Alternatively, the fully developed embryo may fail to hatch due to its reduced vitality, or may die after hatching. All in all, the result of the mycotoxin transference into the egg and offspring is impaired fertility and hatchability, which leads to less day-old chicks per breeder hen.

Conclusion

As poultry may be confronted by such a huge number of different mycotoxins it is essential to apply an efficient and successful mycotoxins risk management programme.

The Mycofix product line represents a complex solution for successful mycotoxin risk management.

Biotransformation agents may become the technology of choice, as enzymatic reaction offers a specific, irreversible and very efficient way of detoxification that leaves neither toxic residues nor undesirable by-products.

The elimination of adsorbable mycotoxins, such as aflatoxins and ergot alkaloids can be achieved through adsorption, while selected plant and algae extracts that counteract the effects of non-degradable mycotoxins complete the picture for the successful control of mycotoxins. ■

References are available from the author on request