

Mycotoxins and their effect on the health of breeders

Mycotoxins are toxic secondary metabolites produced by moulds pre- and post-harvest and are ubiquitous in the environment. The global presence of mycotoxins in the feed of breeders can have a detrimental effect on health and performance of both breeding poultry species and their progeny.

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The main mycotoxins commonly discussed when considering feed security are aflatoxin (Afl), Zearalenone (ZEA), deoxynivalenol (DON), fumonisin (FUM), T-2 toxin (T2) and ochratoxin (OTA). These mycotoxins can impact breeder productivity in several ways, including reduced egg production, impaired egg shell quality and increased embryonic mortality.

Which mycotoxins are present in feedstuffs?

Mycotoxins rarely occur in isolation and therefore, whilst mycotoxicosis in breeders is relatively rare, breeder feed contamination with a broad spectrum of low level mycotoxins is common.

Many analyses for mycotoxins come back with values below guideline threshold levels (Table 1), however this does not give a full

Table 1. EU guidance on mycotoxin limits in complete feedstuffs for poultry species. (ppb = parts per billion) (Recommendation 2006/576/EU; *Directive 2002/32/EU; **Recommendation 2013/165/EU).

Mycotoxin	Clinical signs	Limit (ppb)
Aflatoxin	Immune suppression, liver and kidney disorders, systemic haemorrhages, leg and bone problems	20*
Zearalenone	Impaired fertility	None given
Deoxynivalenol	Reduced productivity, vomiting, diarrhoea and haemorrhage	5,000
Fumonisin	Respiratory issues, pulmonary oedema and hepatic necrosis	20,000
T-2 Toxin	Oral lesions, reduced productivity and feed refusal	250**
Ochratoxin	Nephropathy and impaired fertility	100

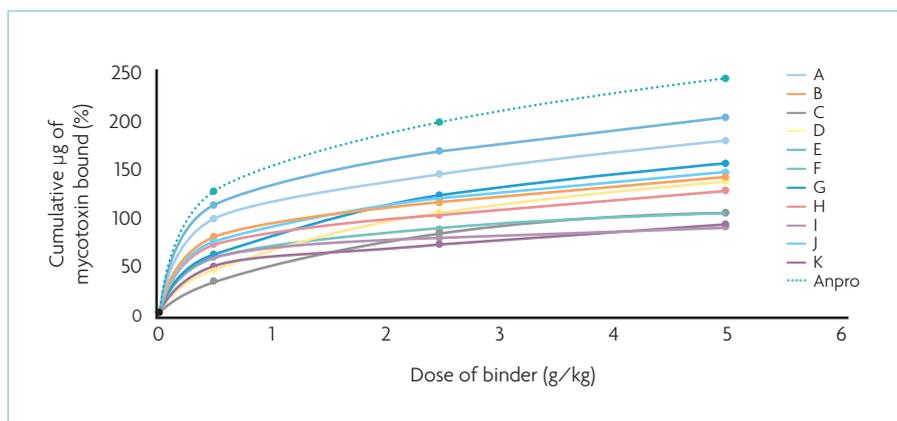


Fig. 1. Dose response of mycotoxin binders at pH 2.5.

picture. A feed containing many different toxins below threshold levels may be more problematic than a feed containing a single toxin at a high level.

Why are mycotoxins an issue for breeder enterprises?

Ensuring the best possible reproduction rates for breeders and the production of the highest quality eggs is fundamental in ensuring profitability.

Issues with egg production and quality, as well as increased susceptibility to disease, can severely affect the success of a breeder business and the presence of mycotoxins can have a detrimental impact in achieving such success.

Mycotoxins and egg production

Aflatoxin contamination of feed has been reported to negatively impact reproductive status as a result of poor egg production and reduced egg weights.

It has been hypothesised that this occurs as a result of aflatoxins being involved in the development of follicular atresia of the ovaries of poultry species.

This has been seen in studies whereby laying hens have been fed diets contaminated with aflatoxin and histological examination has demonstrated such an effect.

Follicular atresia is a normal process of the degeneration of ovarian follicles, however the enhancement of such a process due to the presence of aflatoxins, as has been previously reported, could attribute to reduced breeder productivity in the presence of mycotoxins.

Mycotoxins and egg quality

The breeder industry suffers huge losses from the breakages of hatching eggs. Good eggshell quality is essential in the preservation of embryos and dietary mycotoxins can lead to eggshell defects.

The egg shell is not only required in order to protect the embryo, but it also serves a physiological function in the role of gas exchange and provision of calcium for

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embryonic development once yolk stores are depleted.

Previous studies have found that the presence of both DON and T-2 toxin has huge implications on egg weight and shell thickness, with 12% increases in cracked eggs being reported in eggs from hens fed rations contaminated with T-2 toxin. In addition to this, aflatoxin B1 has also been found to have an impact on egg shell quality with reduced shell weights.

It is thought that this is due to the effect that aflatoxins have on liver function, specifically the production of vitamin A.

Vitamin A is crucial in the maintenance of several organs, including the shell gland. Therefore, if the production of vitamin A is reduced due to the presence of aflatoxins, shell gland function will likely be impaired.

As well as the effect of aflatoxins on liver function, the presence of this mycotoxin is also associated with reduced levels of circulating calcium and phosphorous content in the blood of poultry species, reducing the overall egg shell quality and calcium content available to the developing embryo.

Mycotoxins and embryonic mortality

The presence of dietary mycotoxins of the Fusarium family, including DON, ZEA and T-2 toxin, are all associated with elevated embryonic mortalities when present in the feed of breeding hens particularly during early development.

Such an increase in embryonic mortality is not fully understood, but is hypothesised to be as a result of the impact previously discussed on egg shell thickness.

Eggshell thickness can affect moisture loss during the incubation period, and

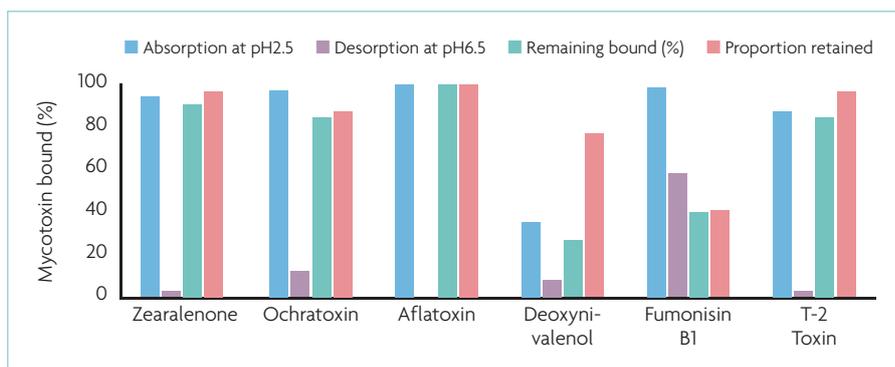


Fig. 2. Broad spectrum mycotoxin binding of Anpro Advance (from Anpario plc) in a desorption test at pH2.5 and pH6.5.

hatchability can be reduced as shell quality deteriorates causing early embryonic mortality.

Mycotoxin mitigation

The negative impact of mycotoxins on breeder hen performance can be significantly reduced by the addition of an effective binder in the dietary ration.

The most widely used mycotoxin binders contain clays and/or yeast cell wall fractions.

There are many different products commercially available, all with numerous claims and studies demonstrating their efficacy in binding toxins in vitro as well as in vivo, making the choice of the most suitable binder difficult and confusing at best (Fig. 1).

These products work by simple adsorption of the mycotoxins onto sites on the binders, thus allowing the toxins to pass through the animal without causing problems.

Some products contain enzymes, that in addition to simple adsorption, biotransform

certain mycotoxins into secondary metabolites. Most mycotoxin binders are effective to some extent but it is misguided to assume that they are all the same, are equally effective and that their use can eliminate the threat posed by the ubiquitous toxins.

Generally, binders work more effectively in acidic conditions, such as that of the proximal small intestine of the birds' gastrointestinal tract, and it is the loss of binding at higher pH levels in the lower intestine that needs careful scrutiny.

Some mycotoxin binders are better at binding certain mycotoxins than others. DON and ZEA are two mycotoxins which are notoriously difficult to bind, yet elevated levels of these mycotoxins can have a detrimental impact on breeder hen performance.

Therefore finding a binder which can successfully bind a broad spectrum of mycotoxins, helping to reduce the risks associated with multiple low level mycotoxin contaminations, is of the utmost importance (Fig. 2) in ensuring breeder hen health and performance. ■