The hidden risks of mycotoxicosis for breeding hens

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As the threat of mycotoxins for poultry become more evident via research, so we increasingly understand how they affect breeding stock, which can have an impact on the resulting progeny as well as their parents.

Although the performance of breeders is monitored very closely during their production cycle, some of the threats from mycotoxin contaminated feed are long term and may not be immediately evident for some period of time before causing the performance and the well being of the animals to be compromised.

Hence, as in all animal feeds, ensuring minimal mycotoxin exposure by the use of a proven binder is paramount in protecting welfare, egg and embryo quality and overall production in breeder flocks.

Mycotoxins can be expressed in any feed which contains fungal material. The type of basal feed ingredients, weather and management at harvest, storage conditions and feed production methods all have an impact on the potential for contamination with toxins in breeder feed.

Potentially hazardous fungi include those found on grain and in straw or other bedding materials, as well as fungal contaminants associated with storage of materials.

Fungal growth requires a suitable substrate, moisture levels exceeding 14% RH, temperatures above 60°F, 0.5% oxygen and a pH ranging between 4 and 8, depending on the species of fungus. If growing seasons and harvests are poor, leading to increased grain moisture, and storage conditions are not ideal, fungal growth is inevitable, and contamination is impossible to avoid.

Broiler breeders.

Typical fungal species and their toxins associated with feed and bedding contamination are shown in Table 1. In general, nearly all mycotoxins are associated with poor egg production in poultry, although they additionally have specific symptoms.

Aflatoxins

Aflatoxin is a common problem, especially in corn based diets, and is known to reduce laying efficiency and egg quality in general.

Stanley et al., (2004) ran trials to examine the effect of aflatoxicosis in broiler breeder hens. Hens were fed diets supplemented with aflatoxin (3mg/kg) compared to an uncontaminated control or the treatment diet plus mycotoxin binder.

The researchers found that the aflatoxin contaminated diet affected hen-day egg production (57.6%), percentage of hatchability (67.6%) and embryonic mortality (24%). Serum total protein, globulin, and albumin were significantly ($P < 0.05$) impacted by presence of aflatoxins. Hatch of fertile eggs from hens fed contaminated feed was significantly reduced compared to those fed the control diets (67.6 vs. 78.5%).

Supplementation with the mycotoxin binder improved hatchability (74.9 vs. 67.6%), egg production (65.83 vs. 57.26%), and lowered embryonic mortality (16.8 vs. 24%). Serum globulin and albumin was decreased in hens fed contaminated feed but was partially reversed in the presence of binder.

Cyclopiazonic acid (CPA) specifically affects shell strength, and can interfere with bone structure and maintenance due to reduced mineral uptake from the gut. Fatty liver is a commonly seen symptom of this type of intoxication. This is important in

Continued on page 9

Table 1. Moulds and mycotoxins commonly found in feed and bedding materials.

Field origin	Storage origin	
FUSARIUM	PENICILLIUM	ASPERGILLUS
Deoxynivalenol	Ochratoxin	Aflatoxin
Zearalenone	PR	Ochratoxin
T-2	Patulin	Sterigmatocystin
Fumonisin	Penicillic acid	Fumintremorgens
Moniliformin	Citrinin	Fumigaclavins
Nivalenol	Penitrem	Fumitoxins
Fusaric acid	Cyclopaizonic acid	Gliotoxin

Continued from page 7
longer lived and valuable breeder hens. Research has reported a significantly higher incidence of cracked or shell-less eggs from hens affected by CPA, especially when it is present in feed at levels of 2.5mg/kg body weight.

Ochratoxins

Ochratoxins are important toxins produced by several species of fungi and are generated when feedstuffs are poorly stored. Source fungi are found in temperate as well as in tropical regions, with ochratoxin A dominating.

For all types of poultry, the main problem with this particular toxin is its ability to cause damage to the proximal tubules, resulting in the kidney becoming pale and grossly enlarged. As with aflatoxin, fatty liver can occur with ochratoxin exposure, sometimes associated with mortalities due to acute renal failure.

Ochratoxin has been implicated in problems with egg laying performance, poor shell quality, reduced embryo viability and decreased hatchability. Recent investigations with laying hens suggest that ochratoxin in bile, collected directly from the gall bladder, can be used as a bio-marker to identify affected flocks.

Trichothecenes toxicity has many symptoms in poultry. Those with notable impact in breeder hens include reduced weight gain and egg production, poor shell quality and increased breakage, reduced female fertility and hatchability of fertile eggs, tibia dyschondroplasia and regression of ovaries.

Hormones are, of course, very important in any breeding animals. Some mycotoxins, such as zearalenone, are hormone-mimicking compounds.

Zearalenone toxin production often occurs in combination with deoxynivalenol in naturally contaminated cereals, and is responsible for reproductive disorders due to its ability to mimic the action of oestrogenic hormones. Although it is reported that zearalenone has limited toxicity to birds, exposure to high levels of contamination in feed can cause vent enlargement and enhanced secondary sexual characteristics in poultry.

A review of the impact of mycotoxins on poultry performance reported that zearalenone contamination in laying hen feed caused reduced egg specific gravity, poor shell thickness and inferior shell development. This indicates that poultry may be more susceptible to the hormonal impact of this toxin than previously thought.

Fusarium mycotoxins in laying hen diets are associated with reduced feed intakes and poorer FCR when studied under controlled conditions.

Trials have shown that egg production can be significantly reduced (P=0.0002) from 95 to 81% after four weeks of receiving the contaminated feed, and remained significantly lower until week eight, as did the incidence of lower egg mass.

Parameter	Uncontaminated control	Contaminated feed	Contaminated plus 0.2% binder	P Value
Eggshell thickness (um)	32.08[b]	30.18[a]	31.56[b]	0.04
Early embryonic mortality 1-7 days (%)	5.42[a]	21.52[b]	2.38[a]	0.03

Table 2. Impact of feeding fusarium contaminated feed to broiler breeders (4 weeks) (Yegani et al, 2006).

Mycotoxin trials

Yegani et al. (2006) ran a trial with broiler breeders and roosters where they fed diets contaminated with mixed fusarium mycotoxins (from naturally contaminated grains) versus an uncontaminated control or the treatment plus 0.2% mycotoxin glucomannan binder.

The trial lasted for 12 weeks, from 26 weeks of age. Reduced eggshell thickness was observed after four weeks exposure to the toxins, although supplementation with the binder prevented this problem.

A significant increase in early (1-7 day) embryonic mortality at week four was observed in eggs from hens fed contaminated grains (Table 2).

More recent trials, where broiler breeders again received fusarium contaminated diets, confirmed decreased shell thickness and increased early embryo mortality. Multi-factorial effects are also known to occur with contaminated diets.

Trials with broiler breeder pullets infected with coccidiosis and exposed to fusarium contaminated feed revealed that the presence of these mycotoxins caused problems in gut functionality, with significantly reduced villus height (and hence absorption surface area) in the duodenum, although there has been data showing that other areas of the gut develop a larger surface area to accommodate these losses in absorptive efficiency.

Trials examining the impact of fusarium mycotoxins on brain chemistry in poultry found that, although growing broilers showed reduced levels of 5-HT in the pons region of the brain, this was not observed in further research using 26 week old breeder hens.

To date, the data generated regarding the impact of mycotoxicosis on broiler breeders shows that these types of poultry are, in fact, sensitive to toxins, whereas previously it was considered that they were impervious compared to other species.

Breeder producers and feed manufacturers should make sure that feed destined for valuable breeder flocks contains a suitably efficacious and broad spectrum mycotoxin binder, such as that developed by Alltech, to prevent any negative impact on performance and welfare within the flock. ■

References are available from the author on request

Mycotoxin contaminated feed pellets.