Preventing aflatoxin toxicosis in duckling production

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Duck meat is gaining popularity worldwide, with an average annual increase of 3.4% from 2000-2010. By 2010, production had reached 4.03 million metric tonnes and is predicted to reach 4.60 million tonnes by 2015. With this growing demand and popularity, it is essential that the performance and health of the birds is not compromised.

Mycotoxins can affect many aspects of animal production including performance, health and welfare. Aflatoxins are secondary metabolites produced by the fungus Aspergillus flavus and A. parasiticus, which grow on grains and oilseeds.

Infestation can occur in storage and before harvest. Corn, a primary energy source for animals, can become contaminated due to a variety of reasons.

Stress conditions at pollination, drought, insect damage, improper storage conditions and temperatures above 25°C favour Aspergillus growth.

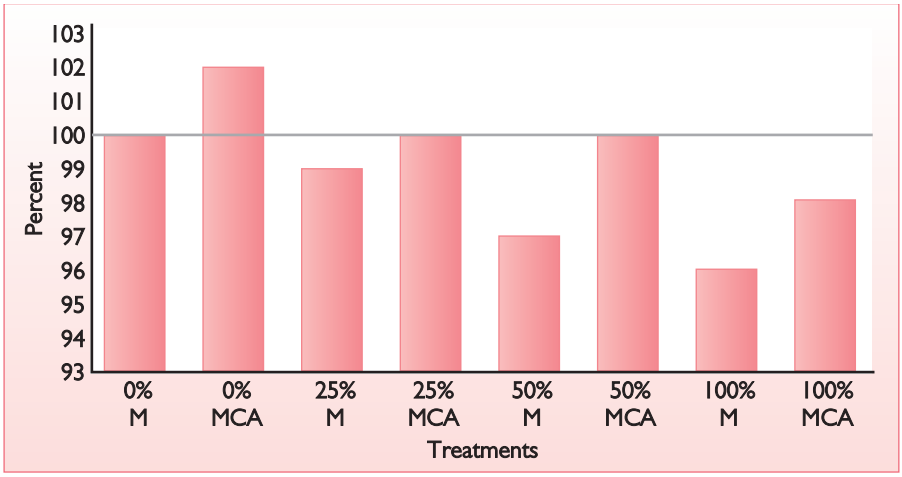
Aflatoxin B_1 is the most common metabolite and is extremely toxic, mutagenic and carcinogenic. Toxic effects will depend on species, age, duration of exposure, dosage and nutrition of the animal in question.

Ducks, and especially ducklings, are extremely sensitive to aflatoxin in the feed. Negative effects include organ and tissue damage (especially to the liver), reductions in growth performance, health, immune function and ultimately, mortality.

Therefore, the ability to prevent toxicity before it occurs improves the economic, health and welfare of duck production.

Experts at Amlan International have been working with researchers around the world to explore ways to tackle this serious problem and provide solutions for producers.

Fig. 1. Relative body weight gain of the ducklings fed aflatoxin contaminated diets compared to the controls.



Guide to treatments:

0% M = Low aflatoxin.

25% M = 25% corn replaced with contaminated corn.

50% M = 50% corn replaced with contaminated corn.

100% M = 100% corn replaced with contaminated corn.

0% MCA = Low aflatoxin plus 0.1% Calibrin-A.

25% MCA = 25% corn replaced with contaminated corn plus 0.1% Calibrin-A.

50% MCA = 50% corn replaced with contaminated corn plus 0.1% Calibrin-A.

100% MCA = 100% corn replaced with contaminated corn plus 0.1% Calibrin-A.

In fact, some interesting results were reported after researchers looked at the effect of corn, naturally contaminated with aflatoxin, on ducklings aged 1-21 days.

Effect on growth performance

The first report looked at four diets fed to 640 ducklings and the effects on haematology and serum biochemistry (Li et al., 2012).

To look at the effects of aflatoxin on growth performance and liver and intestinal health, Wan et al. (2013) utilised the response from those ducks but also reported the results from four (eight total) additional treatments.

Two control diets containing clean corn with and without 0.1% Calibrin-A were used in the experiment. The clean diets with Calibrin-A added were fed in order to determine if the mycotoxin binder had any negative effects on growth performance. Analysed aflatoxin levels for the eight treatments can be seen in Table 1.

Aflatoxin was detected in the uncontaminated diets despite careful selection of the ingredients. However, control diets were still within tolerable levels for aflatoxin contamination (20g/kg, FDA).

This demonstrates the fact that diets can become contaminated during feeding and that it is very difficult to find grains that are completely free of mycotoxins.

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Therefore, implementing a risk management strategy such as the addition of a mycotoxin binder that prevents problems before they occur is extremely important.

Diets were assayed for other mycotoxins (zearalenone, fumonisin, and deoxynivalenol) and determined to be within guidance and advisory levels of the FDA.

In terms of growth performance, average daily gain was decreased when ducklings were fed the highest level of aflatoxin (Fig. 1). There was also a decrease in villus height and villus-crypt ratio in the intestine of ducklings fed increasing amounts of contaminated corn, likely causing interference with digestion.

	Treatment							
	0% M	0% MCA	25% M	25% MCA	50% M	50% MCA	100% M	100% MCA
Aflatoxin (µg/kg)	7.8	8.4	29.7	31.2	52.2	57.4	98.7	103.6

Table 1. Aflatoxin concentration of uncontaminated and naturally contaminated corn-based diets fed to ducklings with or without Calibrin-A.

Including Calibrin-A in the diet significantly improved the condition of the intestine in ducks fed diets containing mouldy corn. Variability in growth significantly increased at the 50 and 100% aflatoxin level, which was alleviated by the addition of the mycotoxin binder. Average daily gain, feed intake and feed efficiency were not affected by Calibrin-A in the clean diet, showing that it did not interfere with nutrient utilisation.

Liver health

The liver is a vital organ responsible for many important metabolic functions in the body. The health of the liver can be evaluated by various methods. For example, different biological molecules such as alanine transaminase, aspartate transaminase, alkaline phosphatase and creatine kinase are enzymes which can be used to assess liver function.

Concentration of these enzymes in the serum of ducks fed contaminated diets (Table 2) was negatively impacted by aflatoxin contamination in the report by Li et al. (2012).

Aflatoxin inhibits protein synthesis, which can prevent essential enzymes from being produced or, conversely, it can cause enzymes to leak into the serum thus increasing blood concentrations.

The decrease in blood urea nitrogen in this experiment confirmed aflatoxin interference with protein synthesis. Liver weight was significantly ($P < 0.05$) decreased by the highest level of aflatoxin in the report by Wan et al. (2013).

This may be indicative of a chronic effect from aflatoxin toxicity on the growth and development of the ducklings. Fortunately, the addition of Calibrin-A to the diets proved very beneficial in protecting the liver from damage (see Table 2), as it returned liver enzyme function back to normal in and reduced the negative impact on liver weight at the 100% M level.

Aflatoxin contamination resulted in serious effects on the health of the birds. Organs and tissues were damaged and the immune system was suppressed. The relative weights of the spleen, thymus and bursa of Fabricius were decreased by feeding the 100% aflatoxin contaminated diet. These organs are essential to the immunocompetence of ducklings. The inclusion of the Calibrin-A significantly reduced the negative effect on the spleen.

Additionally, Calibrin-A reduced the toxicity of the mycotoxin on the thymus and the bursa of Fabricus over that of diets with no added binder at the highest level of contamination (100% M). Reducing the damage caused by mycotoxin contamination to any of these organs is surely beneficial from an immunocompetence and health perspective.

Other components of the immune system,

Parameter:	Report 1			
Haematology:	**0%M**	**0%MCA**	**100%M**	**100%MCA**
Lymphocytes	83.9[b]	83.8[b]	85.8[a]	83.9[b]
Granulocytes	9.9[a]	10.0[a]	8.5[b]	9.7[ab]
Haemoglobin	136.5[a]	135.9[ab]	127.1[c]	131.4[bc]
Serum biochemistry:				
Alanine transaminase	57.3[a]	50.4[ab]	18.0[c]	50.3[ab]
Aspartate transaminase	36.0[a]	33.9[a]	29.0[b]	32.6[a]
Alkaline phosphatase	1,124.5[bc]	1,238.0[ab]	1,317.7[a]	1,085.3[c]
Creatine kinase	1,261.1[a]	1,212.8[a]	1,057.9[b]	1,158.6[a]
Blood urea nitrogen	0.9[a]	0.9[a]	0.6[b]	0.9[a]

	Report 2							
	0% M	**0% MCA**	**25% M**	**25% MCA**	**50% M**	**50% MCA**	**100% M**	**100% MCA**
Relative organ weight (%):								
Liver	3.5[a]	3.5[a]	3.4[a]	3.5[a]	3.4[a]	3.5[a]	2.9[b]	3.4[a]

a d Means within a row not followed by a common superscript are different ($P < 0.05$).

Table 2. Haematology, serum biochemistry and liver weights of ducklings fed aflatoxin contaminated corn with or without Calibrin-A (from Li et al., 2012 and Wan et al., 2013).

such as immunoglobulins, lymphocytes, granulocytes and haemoglobin were compromised by the addition of contaminated grain to the diet in the report by Li et al. (2012). Supplementation of the diets with Calibrin-A reduced the negative effect of aflatoxin on the immunoglobulins regardless of contamination versus diets with no added binder. Calibrin-A also returned the concentration of lymphocytes to the level of the control (Table 2).

Mortality increased in birds fed the 50 and 100% mycotoxin diets, which was significantly ($P < 0.05$) decreased by the addition of the Calibrin-A.

Aflatoxin can seriously impact the very systems that are necessary for the bird to protect itself from disease.

Adding Calibrin-A to the diets provided relief from this onslaught on the health and immune system of ducks.

Mycotoxins can develop after harvest and during processing and storage therefore, it makes sense to prevent severe problems from happening in the first place. It would be reasonable that producers, nutritionists and veterinarians implement a risk management strategy.

Controlling these toxins prior to exerting their damaging effects is simply the right thing to do. Calibrin-A does just that and binds aflatoxin before it can act systemically and is excreted naturally before extensive damage occurs.

It is a safe and effective solution to reduce or eliminate the toxic effects arising from aflatoxin contamination without interfering with nutrient utilisation. ■

References are available from the author on request