Proper mycotoxin prevention improves egg quality

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Modern strains of laying hens are able to maintain an egg production above 90% for a long period of their productive cycle provided that adequate environmental, sanitary and nutritional conditions are met. However, these highly producing laying hens are quite susceptible to any unfavourable condition, including mycotoxin contamination of the feed.

The adverse effects of mycotoxin contaminated diets, sometimes undetectable, could be devastating in terms of reduced egg production and egg quality in layers. Proper prevention of the deleterious effects of mycotoxins must be a regular practice for egg producers to maintain productivity and profitability.

Presence of blood spots in an egg from hens fed a diet contaminated with aflatoxin, fumonisin and T-2 toxin.

Mycotoxins in laying hens

During the past decade there has been an increase in levels of mycotoxin contamination in feed ingredients, as well as the occurrence of multiple mycotoxins in raw materials, particularly grains.

The simultaneous presence of several mycotoxins in the feed causes different effects (additive or synergistic) than those observed with individual contamination. Mycotoxins that have significant negative effects on laying hens are aflatoxin, ochratoxin, T-2 toxin and diacetoxyscirpenol (DAS).

In addition, the co-occurrence of fumonisin and/or deoxynivalenol (DON) and/or cyclopiazonic acid in the feed usually exacerbated the toxicity of the most dangerous ones, mentioned above.

Relative low levels of mycotoxins in the feed without detectable clinical signs in layers can produce serious damage to the immune system, reducing the effectiveness of vaccination programs. In contrast to broiler chickens that have a short production cycle, laying hens are exposed to mycotoxins for a longer period of time, therefore low levels of contamination can accumulate with time, decreasing performance and damaging organs – primarily the liver, kidneys, mouth and gastrointestinal tract.

From the performance point of view, a decrease in egg production is the most common negative effect in laying hens; however there are many egg quality features that are also affected.

Depending on regional consumer preferences, these characteristics can have a significant economic impact.

Mycotoxins and egg quality

Egg size can be severely reduced with the presence of aflatoxin (Table 1) and/or ochratoxin and/or T-2 toxin in the feed. Also, the contamination of aflatoxin plus fumonisin has the effect of decreasing egg size and production.

Aflatoxin, in addition to its hepatotoxic effect, decreases the absorption of lipids by producing diluted bile salts with very low emulsifying activity.

Aflatoxin also causes fat deposits in the liver, increasing its size, and impairing lipid mobilisation to the ovarian follicles. This results in smaller yolks and eggs. Fumonisin contribution to this problem could be related to its effects on the alteration of lipids and protein metabolism in the liver.

Due to the reduced absorption of lipids and its accumulation in the liver; pigments mobilisation to the yolk is also affected since they are fat soluble substances. Therefore a reduction in yolk pigmentation could be observed when laying hens are consuming a mycotoxin (mainly aflatoxin) contaminated feed.

There is evidence that mycotoxins reduce egg shell quality. Aflatoxin and ochratoxin interfere with the metabolism of vitamin D3 because they damage the liver and kidneys, and consequently affect the normal produc-

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Table 1. Effect of aflatoxin on egg size (Adapted from Azzam and Gabal, 1998).

Hen age weeks	Egg size	
	0ppb AFLA (g)	200ppb AFLA (g)
22	52.0	46.3
26	56.0	50.3
30	58.5	51.8
32	59.0	53.0
36	60.0	54.3
40	65.8	55.8
22-40	58.7	52.0 **

** Significantly different (P<0.01)

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tion of 25-hydroxy-D3 and 1,25-dihydroxy-D3. The negative effect of T-2 toxin on egg shell quality could be explained by its effect on nutrient (calcium, phosphorus, and vitamin D3) absorption.

Several field reports indicate that the presence of aflatoxin, particularly when the layer feed is co-contaminated with fumonisin and T-2 toxin, increases the incidence of meat and/or blood spots in the eggs. This effect could be related to the increment in the coagulation (prothrombin) time and capillary fragility produced by aflatoxins.

Mycotoxins can also increase the amount of dirty eggs because they induce high humidity content in faeces.

Besides increasing the amount of dirty eggs, liquid faeces cause serious management problems and make manure elimination very difficult.

Mycotoxins affect renal functions, irritate the gastrointestinal tract and decrease digestion of lipids and protein.

Consequently, hens need to consume more water to eliminate the excess residues and increment kidney excretion leading to the production of high humidity faeces. Dirty eggs are difficult to clean and always present the risk of bacterial contamination.

Use of additives

Proper utilisation of a proven anti-mycotoxin additive (AMA) at the correct dosage can alleviate the negative effects of mycotoxins on layer performance and on egg quality.

Proven AMAs are products that have demonstrated their efficacy in vivo, protecting the target organs damaged by the mycotoxin, with beneficial improvements in animal performance.

Therefore, in selecting an effective AMA it is important to review animal experiments showing the following:

- A scientific experimental design.
- A mycotoxin level that damages the target organ(s).
- Statistical significant improvements when the AMA was added to the diet.
- The AMA must protect the target organ(s) damaged by the mycotoxin evaluated.
- Evidence that the AMA per se is not noxious to the animal.
- Experimental AMA dosage must be the same or close to the commercial dose.

Unfortunately, very few products have demonstrated their efficacy in vivo against more than one type of mycotoxin at a relative low dosage (0.25% or less).

Myco-Ad, a proven AMA, was tested in field conditions with the objective of counteracting the negative effects of a naturally contaminated layer feed. Feed samples were analysed using high performance liquid chromatography; indicating a contamination fluctuating between 100-140ppb of aflatoxin and 100-150ppb of T-2 toxin.

This test was conducted by Avimex in Mexico using a complete randomised design consisting of two treatments, each containing 100 Babcock White 30-week-old laying hens, equally divided in five replicates. For 30 days one group received the contaminated feed and the other the same diet plus the addition of 0.25% of an AMA.

Results from this study, shown in Table 2, clearly demonstrated that an effective AMA can completely prevent the deleterious effect of natural mycotoxins (aflatoxin + T-2 toxin) in egg production, egg weight, egg mass, and the efficiency of converting kilograms of feed into kilograms of eggs.

Conclusions

Mycotoxins can have negative outcomes on the economic returns of egg producers, not only because of their negative effect on egg output and the immune system of laying hens, but also their devastating effects on egg quality. The simultaneous presence of several mycotoxins in layer diets are especially dangerous because it decreases egg shell quality, egg size, and yolk pigmentation; with an increase on the incidence of meat and blood spot in the eggs, and the amount of dirty eggs.

The use of a proven anti-mycotoxin additive, which has been evaluated through experiment(s) in vivo using a scientific experimental design, showing beneficial effects on animal performance with protection of the target organ(s), can prevent the deleterious effects of mycotoxins in laying hens.

Proper mycotoxin prevention should be a regular practice for egg producers to maintain productivity and profitability. ■

Table 2. Effect of the addition of 0.25% of an AMA to a natural aflatoxin + T-2 toxin contaminated feed on laying hen performance.

Treatment	Egg production (%)	Egg weight (g)	Egg mass (g)	Total egg mass (kg)	FCR (kg/kg)
Naturally contaminated feed	88.4[a]	56.9[a]	50.3[a]	95.5[a]	2.16[a]
Contaminated feed + 0.25% Myco-Ad	93.2[b]	58.4[b]	54.4[b]	103.4[a]	2.00[a]

Values with different letters in each column differ significantly (P<0.05)