How to choose the best toxin binder for laying hens

Mycotoxins are toxic compounds produced by various fungal species that grow on various agricultural commodities. The death of 100,000 turkey poults and other poultry in the UK just before Christmas in 1960 was traced to a toxic contaminant (later determined as aflatoxin) present in ground nut meal used in the diet. This incident illustrated the potential threat posed by mycotoxins.

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The toxicity of mycotoxins varies, ranging from hepatotoxic or even carcinogenic (aflatoxins) effects, to estrogenic (zearalenone), immunotoxic (patulin, trichothecenes, fumonisins), nephrotoxic (ochratoxin A) and neurotoxic (tremorgens, ergot alkaloids) effects.

In the field, one of the most important effects of mycotoxins (mainly trichothecenes) is the impact on feed conversion ratio and growth due to lower nutrient absorption (with or without feed intake reduction).

The losses in performance, the increased incidence of diseases and the reduced reproductive performance are of great economic impact in the field. The fate of mycotoxins within the GIT and their metabolism varies between animal species and explains their different sensitivity. For instance, deoxynivalenol (DON) is less absorbed in the poultry gut than in the pig gut and birds are capable of effectively biotransforming DON into deoxynivalenol-sulphate, a non-toxic metabolite. On the contrary, birds show higher sensitivity to type A trichothecenes (T-2/HT-2), ochratoxins, citrinin and fumonisins.

Two large-scale collaborative studies on mycotoxin contaminations were conducted worldwide in 2001 (JECFA) and in Europe in 2003 (SCOOP).

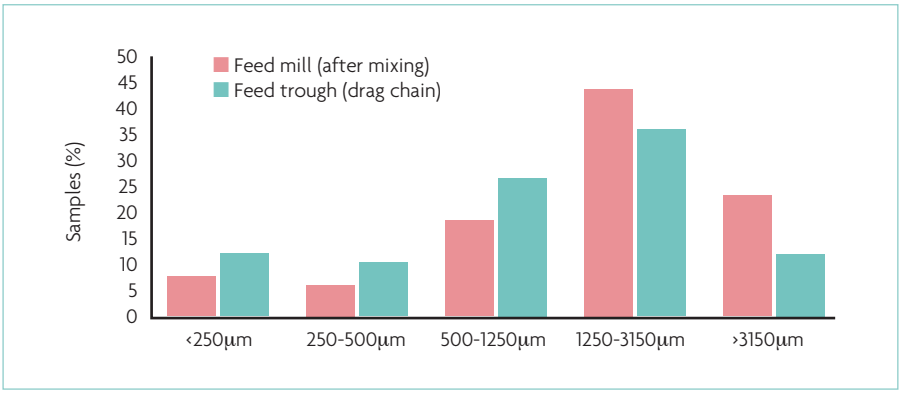
The SCOOP study was run on more than 40,000 feed samples, showing that DON was present in 57%, fumonisins in 46%, zearalenone in 32%, and T-2 in 20% of all tested samples.

The occurrence data of both studies show the high prevalence of polycontamination in feed raw materials.

Recent local and global surveys show that the mycotoxin occurrence remains as high as in early 2000 and even increases in some areas.

Laying hens are of concern regarding mycotoxins, particularly because of the long period of exposure which increases the risk of health issues due to mycotoxins and the high content of grains in the feed.

Fig. 1. Average particle distribution of feed samples collected in the feed mill and in the feed trough on farm.



Feed segregation and selection by laying hens

Mash fabrication of laying hen feed is a common practice of preparing and presenting feed to pullets and laying hens. Mash feed preparation is divided into three main steps: cracking or grinding of raw materials, mixing and transportation. The feed is transported to the hen house either by truck or mechanical conveyance to the hen house storage bins. From the hopper to the birds, feed is delivered via auger or conveyed by a drag chain.

The particle size of mash feeds varies a

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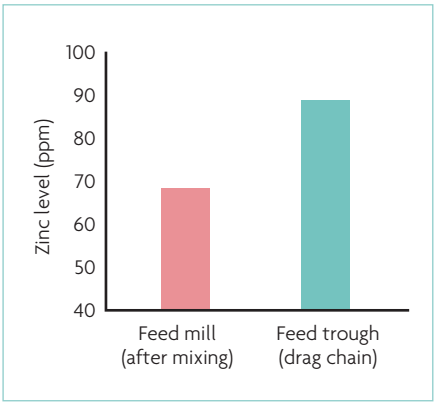

Fig. 2. Zinc concentration in the feed mill and after delivery to the hens.

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lot, from greater than 3mm to below 0.1mm. The variability of particle size is due to the different ingredients comprising the feed. When large particles separate from small particles during the feed delivery, there is a segregation of ingredients leading to a non-homogenous distribution of nutrients and additives to the hens.

The segregation phenomenon is more important for drag chain systems and is limited in auger systems.

In addition to the segregation phenomenon, birds are known to sort the feed according to its particle size during feed intake. A study run by Tang et al. (2006) measured the feed particle size distribution between hopper and feed trough.

It was concluded that for both systems of delivery (auger and drag chain), the hens consume a major portion of particles above 1180µm, as the finer particles (<1180µm) were more concentrated in feed troughs than in the hopper.

The analysis of feed particles reveals that the large particles selected by the hens (>1180µm) are mainly carbohydrates, proteins and other nutrients from grains, whereas small particles concentrate vitamins, minerals and amino acids, meaning the premix and the additives.

The accumulative effect

The accumulative effect of segregation and selection by hens was measured during a trial conducted in France by Olmix.

The same laying hen feed lot was sampled five times after grinding in the feed mill before loading in the truck to be delivered to the farm and another five times all along the feed drag chain in the laying hen house.

As in the Tang study, results show that all particles below 1250µm are more concentrated in the feed trough due to the segregation during transportation and the birds' selection at ingestion.

On the contrary, the large particles were less concentrated in the drag chain than in samples taken after grinding (Fig. 1). This can be explained by the hens' sorting behaviour, which favours coarser particles that better fit their beak size.

The zinc level was also measured in order to evaluate the concentration of premix in the drag chain.

The concentration of zinc in the feed drag chain was 29% higher than in the feed after mixing, meaning that 29% of the premix was not consumed (average zinc level after grinding in feed mill = 69ppm, vs 89ppm in the feed drag chain; Fig. 2).

In summary, feed segregation and bird selection lead to an accumulation of small particles composed of micro-nutrients and additives in the feed trough which delays their intake and impair their efficacy.

Choosing the right toxin binder to protect laying hens

Once feed raw materials are contaminated with mycotoxins, there is no applicable method to destroy mycotoxins before feed intake.

The use of a toxin binder is a common method to reduce the mycotoxin absorption in the gut and prevent their toxic effects in the lumen, and thus mycotoxins' deleterious effects on animal health and performance. Different materials have the capacity to bind individual mycotoxins.

Nevertheless, mycotoxin occurrence data show that polycontamination (simultaneous presence of several mycotoxins and their metabolites) is the most common situation.

Therefore, toxin binders need to be efficient against a wide spectrum of mycotoxins, independently of their structural and chemical diversity.

Moreover, as toxin binders' mode of action is based on the adsorption of mycotoxins, the contact between the toxin binder and the mycotoxins has to be favoured. For that purpose, the intake of toxin binder should match the intake of mycotoxins, and so the homogenous distribution of the toxin binder in the complete feed is necessary.

The previous data on mash feed segregation and bird's selection show that it can be challenging to ensure a homogenous and regular intake of small particles, such as powder additives, by laying hens. In order to warrant a continuous intake of the toxin binder during the feed intake, Olmix developed a microgranulated toxin binder, called MMi.S, with a suitable particle size distribution for laying hens (Fig. 3).

The efficacy of MMi.S components has been proven with many in vitro and in vivo trials against a wide range of mycotoxins, including fumonisins and deoxynivalenol.

By using a microgranulated toxin binder, which particle size distribution is adapted to the eating behaviour of laying hens, segregation is avoided and laying hens have a higher intake of the additive and a more homogenous intake of the additive in time, being more likely to match the intake of mycotoxins from the feed.

Consequently, the microgranulated wide spectrum toxin binder better protects the laying hens against mycotoxins, having a great impact on their performance. ■

Local regulations should be consulted concerning the status of this product in the country of destination. All information only for export outside Europe, USA and Canada.

References are available from the author on request

Fig. 3. Particle size distribution of MMi.S compared to a powder toxin binder.