

A new method to reduce zearalenone problems in breeders and layers

Zearalenone (ZEN) is a secondary metabolite produced by *Fusarium* spp. which can be commonly found in commodities such as corn, wheat, and soy. Due to its similar chemical structure to the hormone oestrogen, it is usually related to reproductive disorders in animal species.

by **Lorran Baeumle Gabardo**,
Product Manager, **Biomim**.
www.biomim.com

Poultry species are generally considered to be more resistant to ZEN than other species such as pigs. However, recent publications have been showing the potential hazards of this mycotoxin. The two key factors that contribute to ZEN being considered a potentially hazardous contaminant for breeders and layers are the high prevalence of ZEN in poultry feed, and the negative impact it has on the reproductive tract and egg production.

Levels of ZEN contamination in feed rising

According to the 2020 Biomim World Mycotoxin Survey, 67% of poultry feed samples analysed between 2016 and 2020 were contaminated by ZEN (Fig. 1). Interestingly, ZEN levels increased in the last three years of this period (2018-2020) reaching a prevalence of 71-77% with average

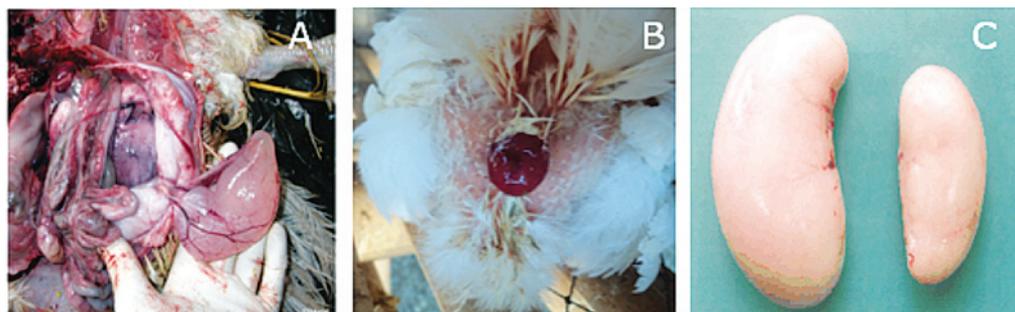


Fig. 2. A: Formation of cysts in the oviduct of breeders that received a diet contaminated with a high concentration of ZEN in the field (Dr Pavel Shkarlat, DVM, PhD). B: Prolapse of the rectum and a reduction of testes size upon exposure to a high dietary ZEN concentration in the field (Prof Charles Rangga Tabbu). C: ZEN results in a reduction in testes size in cockerels. Left - normal; right - atrophied testis in a cockerel that received a diet contaminated with a high zearalenone concentration (Dr Ivan Dinev, DVM, PhD).

levels increased to 64-68ppb. This tendency can be correlated with some extrinsic factors, such as global warming, reduction of crop rotation, and no-till or zero tillage planting systems, which all predispose *Fusarium* to produce more mycotoxins in the field.

Moreover, it is important to remember that ZEN frequently co-occurs with other mycotoxins such as deoxynivalenol (DON) and fumonisins (FB) which are produced by the same fungus and which could have synergistic effects in animals.

ZEN affects the reproductive tract and egg shell quality

For breeders and layers, the ingestion of ZEN can be reflected in

modifications of the reproductive tract and egg shell quality.

Scientific trials showed a hyperactivity of the ovaries with many glands becoming cystic, therefore cystic oviducts were reported in breeders and layers.

Interestingly, it was also observed that the effect was even greater when the toxin was administered in consecutive lower dosages.

Field experiences have shown inflammation in the reproductive tract, the formation of cystic oviducts in naturally high contaminations with ZEN breeders (Fig. 2A) and prolapses of the rectum in layers (2B).

A reduction in testes size was observed in roosters exposed to dietary ZEN (Fig. 2C). Moreover, in commercial egg production, ZEN contamination of the diet was associated with alterations in egg shells leading to a frequent occurrence of cracked eggs in layers and breeders (Fig. 3).

Counteracting ZEN with enzymes

Due to its low polarity, ZEN is considered a mycotoxin that cannot be adsorbed effectively. Therefore,

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Fig. 1. ZEN prevalence and concentrations in poultry feed 2016-2020 (Biomim World Mycotoxin Survey, 2020).



Fig. 3. Alteration in egg shells under a high natural contamination of ZEN (Katharina Haydn, Biomim).



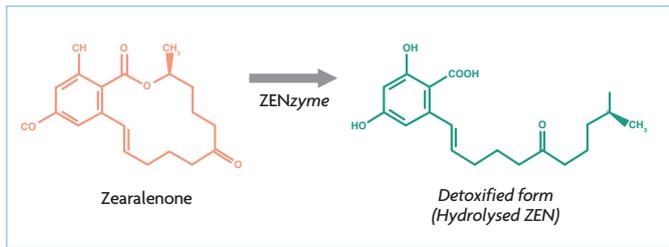


Fig. 4. Biotransformation of ZEN to a non-toxic/non-oestrogenic metabolite.

Treatment group	Number of animals	ZEN (ppb)	ZENzyme (U/kg feed)
Control	32	-	-
ZEN	32	400	-
ZEN + ZENzyme	32	400	20

Table 1. Experimental design.

Continued from page 13 using a simple binder would not be effective to protect the animal against the effects of ZEN. New counteracting methodologies have been researched in this area and enzymes are considered an effective strategy because they are able to break the molecule into non-toxic products.

As a result, Biomin has developed ZENzyme which is a purified recombinant enzyme (zearalenone hydrolase) that breaks down ZEN

resulting in a non-toxic, non-oestrogenic metabolite called hydrolysed ZEN (HZEN; Fig. 4). ZENzyme is part of the new product Mycofix Plus 5.Z (MPL 5.Z).

Efficacy in layers

The efficacy of ZENzyme to degrade ZEN has been successfully tested in layers.

A trial was performed with 96 Lohmann Brown laying hens divided

Fig. 5. ZEN and its detoxified form in excreta (day 14; ng/g). Different superscripts indicate statistically significant differences (p<0.05).

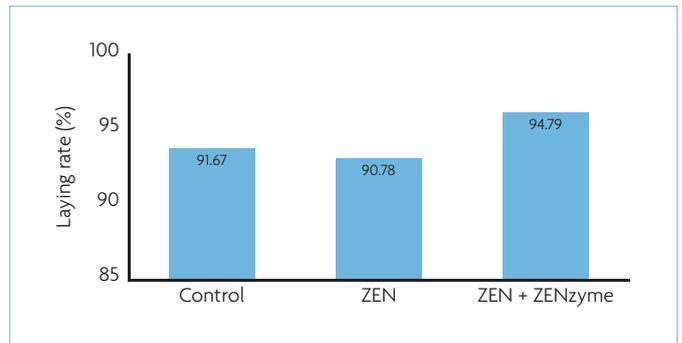
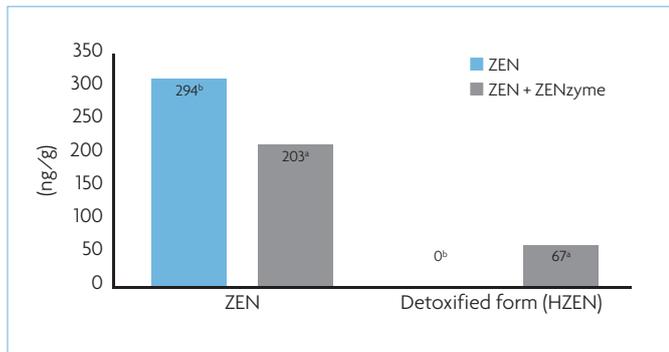


Fig. 6. Laying rate (day 1-14, %).

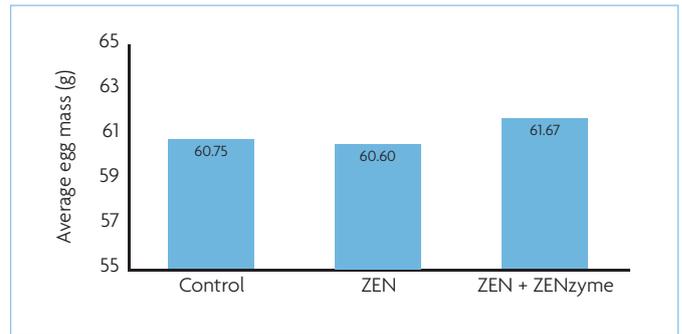


Fig. 7. Average egg mass (day 1-14, g).

into three experimental groups (a negative control group which received the basal diet, a positive control group which received the basal diet plus 400ppb of ZEN, and the ZENzyme treatment group which received the basal diet plus 400ppb of ZEN and 20 Units ZENzyme/kg feed; Table 1).

The zootechnical index of laying rate (%), average egg mass (g) and feed conversion ratio (FCR; g feed/g egg mass) were evaluated over the 14 days of the trial.

The results showed that ZENzyme significantly induced the formation of the detoxified metabolite HZEN (Fig. 5). The performance parameters were also improved with ZENzyme: the laying rate was increased by +4% (Fig. 6), and average egg mass increased by +1g per egg (Fig. 7).

The better indices likely reflect

the effectiveness of the enzyme to biotransform ZEN into non-oestrogenic metabolites in laying hens, helping to improve the overall performance of the animals.

Protecting the performance of breeders and layers

It can be inferred that ZEN is constantly present in the feed, and its effects can induce reproductive disorders and lower performance in breeders and layers.

Strategies other than adsorption should be implemented to counteract this mycotoxin.

ZENzyme shows effective results in the biotransformation of ZEN into non-toxic compounds, protecting the performance of breeders and layers. ■