The occurrence of mycotoxicosis in sows, piglets and pigs

Mycotoxins are the resulting compounds of metabolic processes of fungi from many genera. Such organisms naturally occur in most raw materials used for pig feeding. The existence of mycotoxins in animal feed is generally associated with poor animal performance. Mycotoxicosis can be observed with concentrations below detection limits.

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Faecal score	Treatments		
	Control	ZEA	ZEA + Elitox
0	80	44	31
1	178	165	202
2	29	45	25
3	3	5	5
(0+1)	258	209	233
(2+3)	32	50	30
Mean ranks	395.3	428.88	396.81

Table 1. The effect of challenging sows with 500ppb zearalenone on the incidence of diarrhoea.

The occurrence of mycotoxins is often underestimated due to imprecision in sampling (occurrence of hot spots makes it not always possible to get a representative sample) and imprecision in analysis (occurrence of conjugated mycotoxins).

In this article we focus on two mycotoxins formed by Fusarium moulds and their toxicity to swine.

Effect on swine production

Deoxynivalenol (DON) is a trichothecene produced by Fusarium spp, also known as vomitoxin. Oral exposure causes vomiting, diarrhoea and gastroenteritis, whereas higher doses cause severe damage to the lymphoid and epithelial cells of the gastrointestinal mucosa resulting in haemorrhage, endotoxaemia and shock. Differences in metabolism, absorption, distribution, and elimination of DON among animal species make pigs the most sensitive.

Zearalenone (ZEA) is a non-steroidal oestrogenic mycotoxin, produced by numerous species of Fusarium, a mould that is known to grow in the field. It reduces reproductive performances in sows due to its competition with estradiol in the binding to cytosolic oestrogen receptors.

Swine are the most sensitive of large domestic animals and frequently affected on the farm. It has a synergistic effect when co-occurring with DON. In swine the clinical manifestations of ZEA toxicosis primarily include the reproductive tract.

In gilts, there are swelling of the vulva, vaginal prolapse, enlargement of the uterus, enlargement of the mammary gland, infertility, embryonic death and reduced litter size.

The role of feed additives

Next to controlling mould growth during growth and storage and hence reducing the production of mycotoxins, the absorption of mycotoxins can be controlled at the level of the animal by using mycotoxin eliminating feed additives.

These additives decrease the absorbable amount of mycotoxins by binding, detoxifying, converting, bio transforming or degrading them to less or non-toxic metabolites. An effective binder is one that selectively adsorbs mycotoxins during the digestive process, thus preventing their

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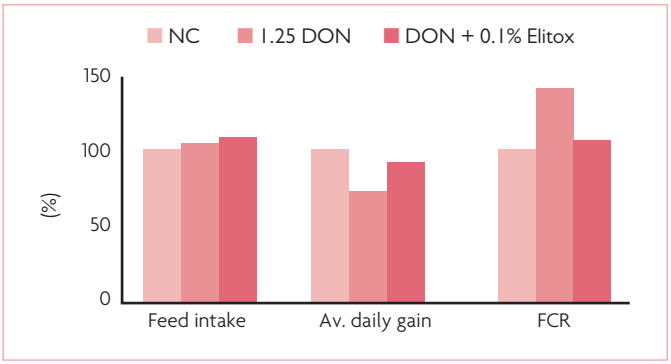
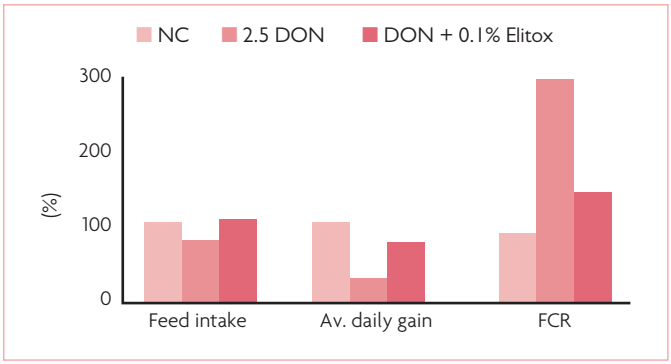
Fig. 1. The effect of challenging piglets with 1.25ppm deoxynivalenol (left) or 2.5ppm deoxynivalenol (right) on feed intake, average daily weight gain (ADG) and feed conversion ratio (FCR).





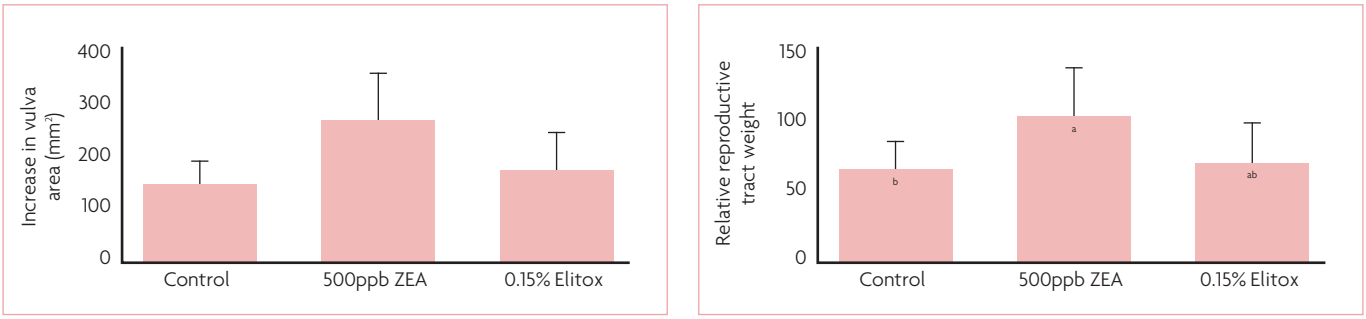


Fig. 2. The effect of challenging sows with 500ppb zearalenone on vulva area (left) and relative weight of the reproductive tract (right).

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absorption in the gut and allowing them to pass harmlessly through the animal. However, due to the limitations of mycotoxin binders, a combined adsorption strategy with alternative strategies, for example irreversible biotransformation to non-toxic metabolites before absorption is recommended. Additionally, the pig's defence mechanism could be supported by the supplementation of immune stimulating natural extracts to reduce the impact of mycotoxins on pig health. The efficacy of such a product has been tested extensively in in vivo trials by Impextraco.

To evaluate the effect of DON two trials were performed on 80 piglets each. In the first trial piglets were challenged with naturally contaminated feed containing 1.25ppm DON, whereas in the second trial piglets were challenged at 2.5ppm. Feed intake was not significantly affected when piglets received 1.25ppm DON, whereas at higher levels of 2.5ppm feed intake was significantly reduced. Average daily weight gain and feed conversion ratio was negatively affected at both levels. The mycotoxin eliminator (Elitox) was added at 1kg/T to reduce the harmful effect of this mycotoxin.

Additionally, different trials on gilts have been performed artificially contaminating them with 500ppb of purified ZEA or with gilts receiving naturally contaminated diets at which purified ZEA was added, either with or without the supplementation of 1.5kg/T Elitox. At these concentrations, ingestion of ZEA did not affect body weight, feed conversion ratio, daily weight gain or mortality. Area of vulva was verified by measuring the dimensions of the organ with a digital caliper (dorsoventral and laterolateral axis).

At the end of the evaluation period, ovaries and uterus were weighed. A significant increase of vulva area and relative reproductive tract weight was observed in all trials when gilts received the contaminated diet. Supplementation of Elitox could counteract these adverse effects on the reproductive parameters.

Next to the zootechnical performance, diarrhoea incidence was verified on a daily basis and a score was attributed according to Vassalo et al., 1997. Ingestion of ZEA resulted in a significant increase in diarrhoea incidence, whereas supplementation of Elitox brought these levels back to control.

Immune supporting ingredients

In the latest trial, blood samples were analysed to verify serum levels of circulating lymphocytes, monocytes and antigen-presenting cells by flow cytometry.

Total serum protein and albumin levels were increased due to the presence of ZEA, whereas the addition of Elitox brought these levels back to control or intermediate values indicating decreased hepatic alterations. Elitox not only contains a binding component (clay minerals) and eliminating component (enzymes) to reduce the mycotoxins, but also has immune supporting ingredients. Flow cytometry is an established method to study immune status by quantifying circulating lymphocytes. The main advantage is that small interferences can be detected with great sensitivity and that specific cells can be targeted in a mixed cell population by labelling them with fluorescent antibodies.

These fluorescent antibodies link with surface molecules that are specific for each type of lymphocyte, making it possible to differentiate them. For example T-helper lymphocytes always carry a CD4 molecule on their cell surface, whereas cytotoxic lymphocytes carry a CD8 surface molecule.

Monocytes can be detected by detecting the Kul surface molecule. T-helper lymphocytes (CD4+) were decreased due to contamination compared to animals supplemented with Elitox. Control animals, receiving no mycotoxins, showed intermediate concentrations.

The amount of circulating cytotoxic T-cells was increased due to ZEA contamination at day 15 compared with the control. The number of circulating monocytes numerically increased by the addition of Elitox, confirming the immune stimulating effect of Elitox also seen in previous trials (data not shown).

The presence of circulating B-lymphocytes was initially lower, but was brought back to control values at later time points. B-lymphocytes are the memory cells producing antibodies. ■

References are available from the author on request

Fig. 3. The effect of challenging sows with 500ppb zearalenone (red lines) combined with a mycotoxin eliminator (blue line) compared to non-contaminated control sows (black line) on the amount of circulating T-helper lymphocytes (first panel), cytotoxic T-lymphocytes (second panel), monocytes (third panel) or B-lymphocytes (last panel).