Algoclay improves mycotoxin protection and improves performance

Mycotoxins are toxic compounds synthetised by fungi, either mainly at pre-harvest (trichothecenes, fumonisins and zearalenones) by Fusarium, or mainly at post-harvest (aflatoxins and ochratoxins) by Aspergillum and Penicillium. Feed materials can be contaminated by different mycotoxins, depending on the cultivation method and mostly on climate conditions.

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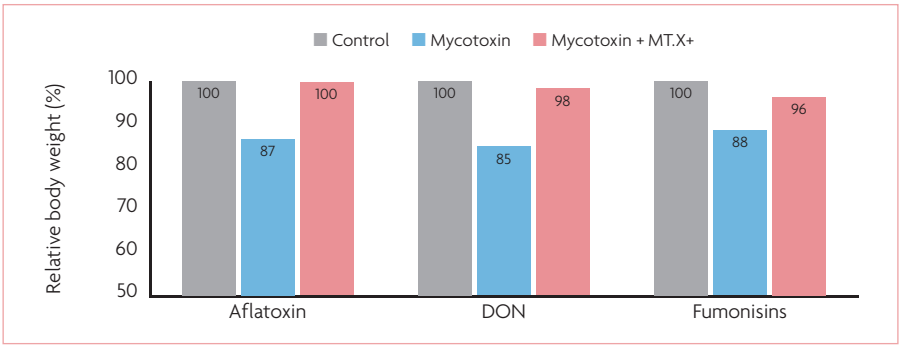


Fig. 2. Effect of MT.X+ on body weight in presence of mycotoxins.

As part of its Myco'Screen offer, Olmix has developed a partnership with a French public laboratory, Labocea. This lab performs contaminant analyses with specific expertise on liquid chromatography-tandem mass spectrometry allowing the simultaneous detection of more than 45 mycotoxins or metabolites.

The Olmix-Labocea database is composed of more than 10,000 feed samples collected worldwide from 2013 to today. This database shows that deoxynivalenol (DON) and fumonisins are the most frequent mycotoxins as 87% and 63% of the feed samples are respectively contaminated (above the limit of quantification) with these mycotoxins.

Aflatoxins remain the most studied mycotoxins because of their high toxicity for animals and man (carcinogenic), nevertheless aflatoxins' worldwide occurrence is lower than DON and fumonisins as these mycotoxins require more specific conditions to develop.

Pigs are considered the most sensitive animals to mycotoxins, particularly to DON and fumonisins, because of the high percentage of cereals in their diet and their specific metabolism. In fact, DON absorption is very rapid and reaches plasma concentration peak within 15-30 minutes of dosing.

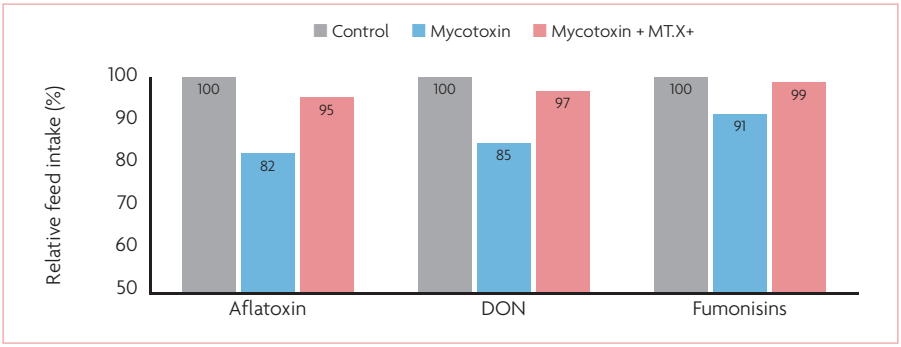
Furthermore, up to 55% systemic absorption occurs in pigs that have been orally administered DON. Acute exposure to high doses of DON induces diarrhoea, vomiting, leucocytosis and gastrointestinal haemorrhage. Fumonisin exposure in pigs is mainly due to ingestion of maize contaminated by Fusarium verticillioides.

Horses and pigs are the most sensitive animals to fumonisins even if intestinal absorption is lower than 10%. Fumonisin acute intoxication of pigs is characterised by functional pulmonary, cardiovascular and hepatic damage. High level of fusariotoxins often lead to lower pig growth due to anorexia. Decreased intake begins to occur when diets containing 0.6-3.0mg/kg DON are fed.

However, when DON levels reach 12mg/kg complete feed refusal is common. At 20mg/kg of DON in feed, important emetic effects are also expected, which is why DON is also called 'vomitoxin'. As fumonisins are less absorbed in the intestine, it induces slight reduced feed intake compared to the intestinal disturbances that it provokes.

Aflatoxins are among the most acutely toxic mycotoxins causing extensive liver pathology, whereas chronic contamination is known to reduce weight gain, feed utilisation, lipid digestion and renal function.

Fig. 1. Effect of MT.X+ on feed intake in presence of mycotoxins.



Mycotoxin effects on piglets under experimental conditions with or without algoclay

A study was conducted by the Samitec Institute of Analytical Microbiological and technological solutions (Brazil) in 2019 in order to measure the effect of three major mycotoxins (fumonisin, DON and aflatoxin) on piglets health and performance and to evaluate the efficacy of MT.X+ to mitigate the effects of these mycotoxins.

MT.X+ is a unique and patented Olmix solution based on intercalated algoclay that aims to protect animals from a wide range of mycotoxicosis. The experiment was divided into three experiments (one per

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mycotoxin). In each experiment, 30 piglets with a mean body weight of 10kg were distributed into five treatments with six replicates; deoxynivalenol and aflatoxin experiments lasted 28 days, whereas the fumonisin experiment lasted 42 days.

The level of mycotoxin used in this trial was set up to obtain significant effects under experimental conditions with mono-contamination, which explains the high levels of mycotoxin that were used: 3mg/kg of deoxynivalenol, 50mg/kg of fumonisins and 1mg/kg of aflatoxin.

The results show that for all mycotoxins tested, a significant reduction of feed intake and body weight was observed and MT.X+ significantly (P≤0.05) improved the piglets' feed consumption (Fig. 1) and thus the final body weight (Fig. 2).

The trial also evaluated the negative impact of mycotoxins on biological parameters and the efficacy of MT.X+ to alleviate these effects. Mycotoxins, especially aflatoxins and fumonisins are very hepatotoxic toxins as they provoke congestion of the hepatic sinusoids, focal haemorrhages, centrilobular fatty cytoplasmic vacuolation and/or necrosis, biliary hyperplasia, and nodular lymphoid infiltration that is often characterised by a pale and enlarged liver.

The relative liver weight is a very good criterion of mycotoxin hepatoxicity. For both aflatoxin and fumonisins, the relative weight of the liver was altered compared to the control, whereas MT.X+ always improved this parameter compared to the mycotoxin group.

Fumonisins have a specific hepatoxicity as they are structurally similar shingosines and are potent inhibitors of sphinganine N-acyl transferase (ceramide synthase).

Fumonisins alter the enzyme secretion in the liver and lead to a rapid accumulation of sphinganine in this organ. Consequently, the sphinganine to sphingosine ratio (Sa:So) evolves and makes a good marker of fumonisins intoxication.

There is increasing evidence for the involvement of sphingolipids in regulating various cellular functions, such as cell-cell interactions, cellular protein and receptor functions, membrane transport, and signal transduction.

In this Samitec trial, the Sa:So ratio was 10 times higher for piglets exposed to 50mg/kg of fumonisin than the negative control (P≤0.05). Meanwhile, the inclusion of MT.X+ in the diet containing 50mg/kg of fumonisin significantly diminished the Sa:So compared to piglets exposed to 50mg/kg of fumonisin (P≤0.05) (Fig. 3). According to the evaluated parameters of this experimental trial, the deleterious effects caused by very high levels of mycotoxins can be alleviated thanks to MT.X+.

Effects of low doses of mycotoxin on piglets

As mentioned, the high level of mycotoxin used in the above trial was set up to obtain significant effects under experimental conditions with mono-contamination, whereas in commercial feeds common mycotoxin contamination levels are far lower.

Recently, more studies focused on the effect of low doses of mycotoxins on animal performance.

For instance, in 2015, Alizadeb et al., measured the impact of low doses of DON (0.9mg/kg) on 35-day-old piglets.

In this study the inclusion of 0.9mg/kg of DON led to 25% reduction of the average daily gain, whereas the feed intake was not affected.

More and more scientific evidence

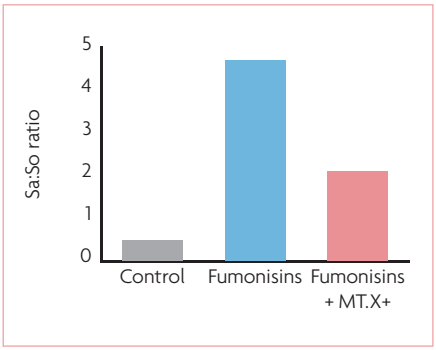

Fig. 3. Effect of MT.X+ on Sa:So ratio in the presence of fumonisins.

demonstrates the risk of mycotoxins even at low doses for animal health and performance. Indeed, in commercial conditions mycotoxins appear together with other stressors that, combined, have a synergistic deleterious effect on the animal's health and performance.

Today, the effect of moderate doses of mycotoxins on swine are more and more documented thanks to both experimental studies and field experience. Special care must be taken with fusariotoxins because of their high occurrence and deleterious effects, even at low doses, and their combination with endotoxins.

In order to protect swine from the negative impact of mycotoxins, MT.X+ shows a very good potential under various conditions all over the world to decrease the impact of mycotoxins on performance and profitability. ■

Local regulations should be consulted concerning the status of this product in the country of destination. All information only for export outside Europe. References are available from the author on request.