Biomanagement of mycotoxins: enzymes offer real solutions

Today, the global mycotoxin challenge is greater than ever. Enzymatic inactivation represents a selective and highly effective solution to this constant matter.

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Fungal contamination of grains is a non-stop concern and, especially due to the current drought, combined with the great adaptability of fungi, and the disruption in the quality feed supply, the mycotoxin prevalence is even more troubling.

Due to the increasing prices of raw materials, more and more farm enterprises are looking for affordable alternatives in the form of various agricultural by-products. Unfortunately the mycotoxin concentration may be multifold higher in these by-products, representing a particularly high health risk, which must be addressed.

Environmental conditions

If environmental conditions are unfavourable, mould spores may stay inactive for long periods and persist in the field. Stress conditions, such as heat waves or heavy drought, result in the production of a variety of toxic secondary metabolites, including mycotoxins.

The international mycotoxin prevalence study by BV Science in 2021 found that 93% of the cereal samples tested positive for mycotoxin presence.

Of these, 67% contained more than one mycotoxin simultaneously. Mycotoxin contamination of feed can predispose numerous livestock diseases, and therefore lead to great economic losses due to the reduced growth performance.

The estimated annual monetary loss due to the mycotoxin contamination of grains is $US900 million.

The simultaneous presence of multiple mycotoxins may generate synergistc, potentiating effects, that is to say, different mycotoxins acting on different parts of the same cellular pathway may exacerbate a disease greater than the sum of the two individual mycotoxins. For example, T2 increases reactive oxygen species (ROS) levels, whereas Aflatoxin B1 inhibits the ROS clearance mechanisms resulting in a ROS imbalance and greater cellular damage.

Enzyme inactivation mechanisms have proven to be an efficacious platform for detoxification of mycotoxins, which are poorly controlled by traditional mechanisms in animal production.

Studies in the areas of microbiology and enzymology have led to the discovery of enzymes produced by micro-organisms that are capable of catabolising (breaking down) mycotoxins.

Enzymes are very specific, as they catalyse specific chemical reactions at specific sites in molecules. At the same time, enzymatic activity is also dependent on environmental characteristics such as temperature, pH or activators and inhibitors from the environment.

Our scientists discovered enzymes that are specific for inactivation of the mycotoxins relevant in monogastric animal production. Dr Bata Ltd have developed Detoxa Plus, an efficacious and safe enzymatic inactivation agent that targets an array of mycotoxins commonly found in animal feedstuffs, and specifically formulated for the control of the most prevalent mycotoxins in monogastric animal feed.

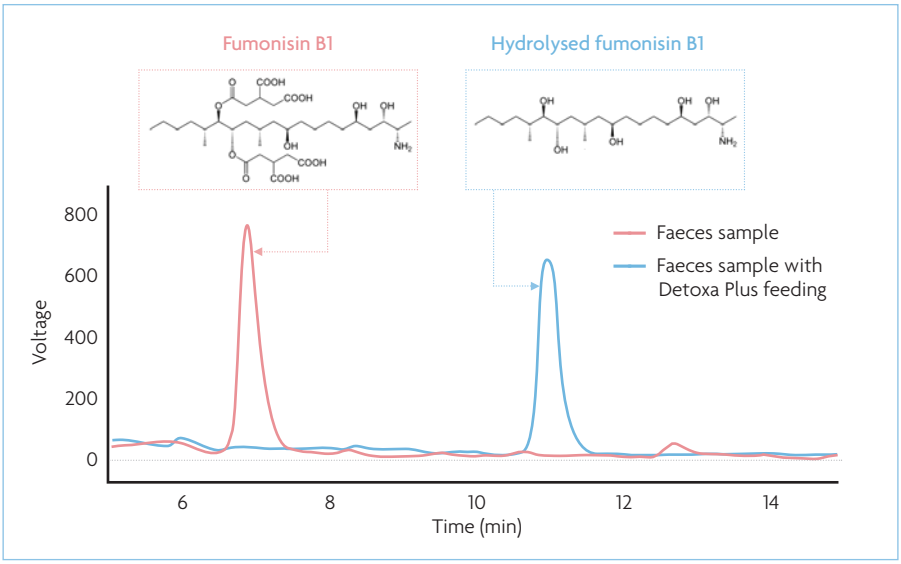

Fig. 1. Comparison of fumonisin B1 content of faeces before and after feeding Detoxa Plus. With feeding Detoxa Plus, only hydrolysed fumonisin B1 is present in the faeces.

Mycotoxin degradation analysis

In vivo mycotoxin degradation analysis proves the efficacy of Detoxa Plus. The fumonisin B1 content is measured in poultry faeces before and after Detoxa Plus feeding, as shown in Fig. 1. Fumonisin B1 is not metabolised by poultry, thus showing its toxic effects. It is excreted in its intact form as shown on the red trace on the figure.

Enzymes in Detoxa Plus inactivate fumonisn B1 at the beginning of the digestive tract, thus only the inactivated, harmless hydrolysed fumonisin B1 is present in the faeces.

Enzymatic inactivation of mycotoxins is the most specific method for managing the ever-present problem of mycotoxin contamination of feed. Detoxa Plus offers a guaranteed inactivation efficacy for, currently, the most problematic and prevalent mycotoxins in animal feed. ■

References are available from the author on request