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Measuring and managing mycotoxins

Mycotoxins pose an ever-present risk to animal production. Everywhere food and feed crops are produced and stored, mycotoxins are inevitably present, causing substantial losses for farmers and producers. The impact and severity of mycotoxicosis on animals are influenced by various factors, of which the concentration of a single mycotoxin is but one.

Testing the levels of single toxins is not nearly enough to create a complete picture of the risk presented by these toxins. In fact, it provides only a partial and extremely low-resolution image.

The detection challenge

Mycotoxins are seldom found in isolation. Usually more than one toxin is present and the synergism between different mycotoxins can produce more acute symptoms than the mere concentration of each individual toxin can explain. It is a case of 'the whole is equal to more than just the sum of the parts'.

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While the detection of single mycotoxins has certainly come a long way, it remains difficult and relatively expensive. Various techniques are available, from on-farm strip tests to expensive quantitative analysis in dedicated laboratories. However, the value of even the most expensive analysis can be limited.

The reason is simply that mycotoxins are usually present in very small quantities, measured in parts per million (ppm) and parts per billion (ppb), and often occur below the detection limit of even the most sensitive analysis techniques. However, even at these low levels, a single mycotoxin can cause subclinical mycotoxicosis and, as mentioned, single-toxin contamination is rare.

Aspergillus *(left) and* fusarium *(right) found in batches of maize silage. (Photographs: North Dakota State University)*

The synergism between undetected mycotoxins can lead to substantial economic losses over time, for seemingly no reason. In complete feed, various raw materials from different geographical areas, each with different and unique mycotoxin profiles, are mixed together. This creates yet another layer of toxic synergism to challenge the animal. Furthermore, the easy-to-use farm strip tests are only validated for single mycotoxins in single matrices and are not suitable for use in complex matrices as found in complete feed.

Masked toxins in feedstuffs

Mycotoxins are also often bound to different molecules in feedstuffs, rendering them invisible to quantitative analysis, regardless of the technique used. These are referred to as masked toxins. These masked toxins are liberated throughout the gastrointestinal tract (GIT) due to changes in pH and the actions of digestive enzymes.

The problem is their presence is unknown in the first place, so no measures can be taken against them. As different types of masked toxins are released

throughout the GIT, they join the pool of free toxins, increasing the real level of mycotoxins in the animal and contributing to the existing toxic synergisms.

Occurrence of mould hotspots

Apart from the difficulty of accurately measuring the actual level of mycotoxins in raw materials, proper sampling also presents certain challenges. In forages and silage, mould hotspots present the biggest challenge to representative sampling.

The widespread occurrence of hotspots adds another level of uncertainty to the real value of mycotoxin analysis. Sampling protocols have been developed to enhance sample integrity and work well with grains and cereals that have been stored and handled before incorporation into complete feed; however, these protocols do not adequately mitigate the risk hotspots pose during the sampling process in silage and fodder.

Measure less, manage more

The number of potential toxic fungal metabolites have been estimated to run into the thousands. Of those potential thousands, only around 300 have been isolated and identified, and yet we spend millions of rand each year analysing for just six. Add to that a questionable correlation between analysis results and actual potential levels of toxins, and it seems that we are shooting in the dark. If analyses were 100% accurate, we could at least hit six targets out of 300 that we know of.

The reality is, we just do not have the tools or the knowledge to snipe at mycotoxins. A broader, more holistic approach is needed; although, admittedly, at this point there is very little to be done to limit the growth of mould on crops. But perhaps, instead of putting all our efforts and resources into measuring how much of the handful of toxins that can be measured there are in feed, we can focus on supporting the animal to deal with the toxins that are present, whether we know about them or not.

It is easy enough to bind aflatoxin, but there are at least 299 others that pose more of a challenge. Alternative strategies should be considered to not just bind and transform specific toxins in the digestive tract, but to eliminate toxins and their effects in the animal. These efforts should be combined with strategies to ensure gut integrity with healthy tight cell junctions to improve gut health, as well as efforts to control chronic inflammation and boost the immune system.

There is value to be found in focusing less on measuring mycotoxins, and more on eliminating their detrimental effects. ❖

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