Ruminant-specific solutions to the in-feed mycotoxin problem

Nowadays, it is widely accepted that mycotoxins in feed pose a significant threat to cow health and productivity. Yet the nature of that threat, the factors which shape it and the implications for cow performance are much less well understood.

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For example, the levels and types of mycotoxins in feed can vary enormously, both due to the conditions before and during crop harvest, and how carefully the resulting feeds are stored and managed. There are also significant differences in the way in which ruminants are exposed to, and are affected by, mycotoxins compared to pigs or poultry.

In addition, although the general rise in awareness of the mycotoxin problem in recent years has increased the use of in-feed mycotoxin deactivators and binders, until now there has been little research and development focused on the specific needs of ruminants.

Fortunately, that is now changing, with growing evidence supporting the rationale that species-specific solutions to the mycotoxin challenge are the most effective.

Ruminant-specific issues

The rumen, at pH 5.5-6.0, provides a very different environment for any mycotoxin deactivators or binders than found in the stomach of pigs and poultry (pH 2-3). Unlike monogastric livestock, ruminants also have the ability to degrade some mycotoxins in the rumen, providing the rumen is functioning at an optimal pH.

However, rumen pH varies considerably during the day, and as rumen pH falls following meals containing rapidly fermented feeds like starch, the microbial activity responsible for degrading mycotoxins is drastically reduced.

The problem is particularly acute if cows are suffering from sub-acute ruminal acidosis (SARA), which damages the lining of the rumen and allows mycotoxins to pass directly into the bloodstream.

Symptoms	Mycotoxins				
	Aflatoxin	Fumonisin	Trichothecenes (DON/T2)	Zearalenone	Ochratoxin A
Impaired rumen function	✓		✓		
Intestinal haemorrhages			✓		✓
Reduced immune function			✓		
Diarrhoea			✓		
Lameness		✓	✓		
Reduced milk production	✓		✓		
Increased mastitis			✓		
Milk contamination	✓		✓		✓
Swollen hocks		✓	✓		
Reduced fertility			✓	✓	
Reduced feed efficiency			✓		
Reduced feed intakes			✓		

Table 1. Effects of different mycotoxins on cow health and productivity.

Understanding the threat

Unfortunately, feeds high in rapidly fermentable energy that increase the risk of SARA – high-starch concentrates, cereals, maize and wholecrop cereal silages – are also more likely to be contaminated with mycotoxins.

According to the results of a recent study, 90% of maize silage samples tested positive for mycotoxins, as did two thirds of wholecrop cereal silages and 71% of total mixed rations (TMR).

In addition, greater than half of the maize silage samples contained more than one mycotoxin, and previous studies have shown contamination of cereal-based concentrates at similar levels.

The most important mycotoxins for ruminants are those produced by the Fusarium moulds commonly found on cereal crops, including maize. Because these crops are harvested at full maturity, they are exposed to the elements for longer and are more prone to fungal infections than grass.

In contrast, very few grass silages are contaminated with Fusarium mycotoxins. Most of the challenge for grass silage comes from the moulds associated with spoilage in the clamp, such as Aspergillus.

The aflatoxins produced by Aspergillus moulds can occur in any feeds stored poorly. This includes silages or moist feeds exposed to air due to poor compaction or damaged polythene sheets, as well as dry feed contaminated with water from leaking roofs, condensation and driving rain, or run-off from moist feeds and forages.

Impact on production

The numerous effects of these mycotoxins on cow health and productivity are shown in Table 1.

In ruminants, the Fusarium mycotoxins deoxynivalenol (DON), zearalenone (ZON) and T2 toxin are the most toxic, with fumonisin (FUM) and the Aspergillus-produced aflatoxin (AFB1) less so.

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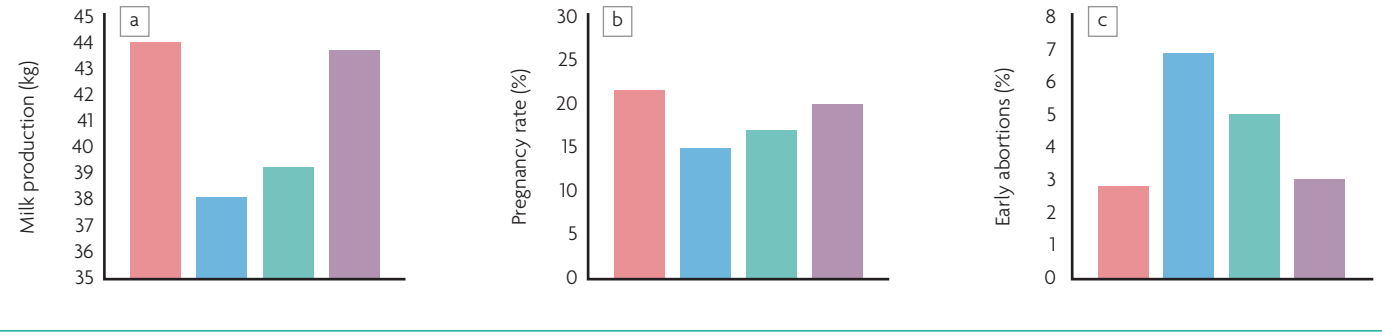

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However, AFB1 is still an important threat, since in-feed contamination can result in aflatoxin M1 (AFM1) in milk. As a human carcinogen, AFM1 levels are closely monitored, and high levels can result in milk being rejected by processors. There are also anecdotal reports that this transfer of aflatoxin into milk is increased in the presence of other mycotoxins, such as those from Fusarium. This is a good example of the additive or even synergistic levels of toxicity that can result from ruminant rations being contaminated with more than one mycotoxin at a time, making total mycotoxin load an important factor to consider in addition to the individual levels of specific mycotoxins.

Fig. 1. Case study results showing impact of mycotoxic

Average monthly herd performance six months prior t

Herd performance following opening of new maize sila

Average monthly herd performance for six months fol

Average monthly herd performance for six months fol

On-farm performance loss

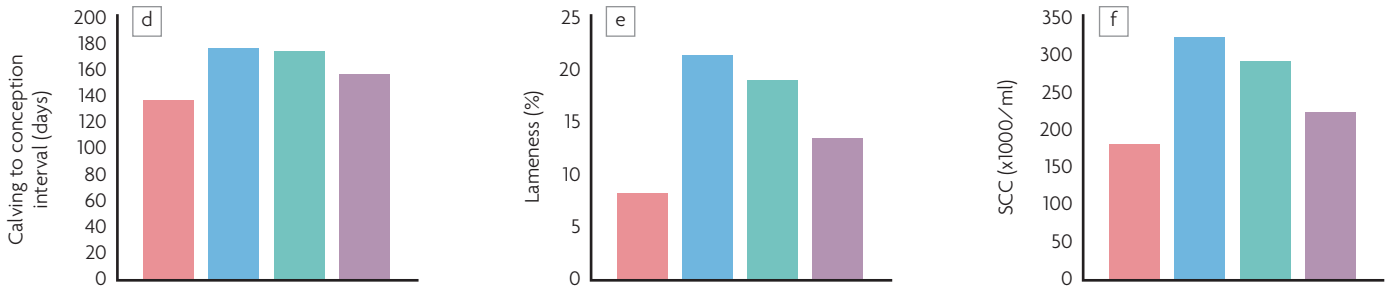
The potential impact is most clearly demonstrated by a case study involving a high performance dairy herd in Italy. Averaging 44.3kg/cow/day (43 litres/cow/day), reports of a sudden drop in milk production, a reduction in reproductive performance and an increase in health problems coincided with the opening of a fresh clamp of maize silage.

As can be seen from the data collected by the farm, and shown in Fig. 1 (a-f), the effect was dramatic. After other potential causes were investigated and dismissed, eventually mycotoxicosis was diagnosed, and analysis of the feed revealed DON, T2 and ZON were present at a total mycotoxin load of 2.49ppm.

The impact of a 6kg/cow drop in daily milk yield (44.3kg/cow to 38.3kg/cow) is serious enough on its own, but when the costs of the other negatives effects on productivity are taken into account, the losses are clearly substantial. Pregnancy rates dropped 9.0%, early abortions rose 4.4% and the calving-to-conception interval increased by 33 days.

The potential impact of mycotoxins in compromising the immune system may also have contributed to both the increase in lameness and any rise in bacterial challenges which elevated somatic cell counts (SCC).

Once diagnosed, the cows were split into two groups supplemented with either a



osis on dairy herd performance.
o contamination
age clamp
lowing supplementation with binder
lowing supplementation with UltraSorb

simple mineral in-feed mycotoxin binder or a de-activator (Ultrasorb) for the following six months. The response was equally substantial, and as can be seen in Fig. 1, those cows receiving Ultrasorb responded to a much greater extent. Daily milk yield recovered to 43.7kg/cow, and pregnancy rates, early abortions and calving-to-conception interval also returned close to original performance.

The key in such situations is to determine the cause of such problems quickly. One option is to get feed samples analysed for mycotoxins using a service like Mycocheck (mycocheck.co.uk), but it is often more cost effective to simply add a ruminant-specific mycotoxin deactivator like the recently launched Ultrasorb R to the ration and monitor the results. A clear recovery in the following 3-4 weeks is a good indication that mycotoxins are at least part of the problem.

Targeted mycotoxin solutions

However, it is important to choose the correct product, as traditional deactivators and binders designed for use across many livestock species are poorly optimised for ruminants. For example, it is now clear that binding performance not only differs from one binder to the next, but also depends on whether it is operating at the near neutral pH of the rumen or the acid pH of a pig's stomach.

The most effective deactivators also include additional biologically active ingredients which transform and degrade certain mycotoxins into less harmful compounds. This is particularly important for mycotoxins that cannot be captured by simple binders, such as those produced by the Fusarium moulds that are so prevalent in ruminant feeds.

Combined with management strategies to minimise exposure – careful clamp consolidation and sealing, storage areas kept free from moisture and vermin, all visibly mouldy feed discarded – the use of a ruminant-specific deactivator such as Ultrasorb R can therefore be highly effective. The key is to ensure mycotoxins are on the list of potential causes as soon as production or cow health starts to suffer, and to act quickly to minimise losses. ■