Findings on mycotoxin contamination in silages and key prevention tips

by Karin Nährer, Mycotoxin Product Manager and Annamaria Boczonadi, Technical Product Manager, Biomin.

A major component of ruminant feed rations are silages. Mycotoxins – fungal metabolites toxic to animals and humans produced by common moulds found in almost all types of grains – can and often do contaminate silages, impairing animal performance and productivity.

Furthermore, some mycotoxins can be carried over from ingested feed into animals' milk, such as the case with aflatoxin. More than 90% of mycotoxins found in feed are already produced in the field, so the first step to avoid mycotoxin contamination in silages should be to minimise the risk at the site of crop production.

In part because mycotoxins are difficult to destroy and despite the use of preventative methods in the field during harvest and storage, mycotoxin contaminations still pose a challenge to dairy cows. An overview on the most important fungal species focusing on the genus Fusarium, Aspergillus and Penicillium found in silages is shown in Table 1.

Mycotoxin contamination is not accurately detected by sight. The absence of visible mould in silage does not necessarily mean that it is free of mycotoxins. The converse also holds true: heavily infested, visibly mouldy silage does not necessarily contain severe levels of mycotoxins. Therefore, monitoring for mycotoxins regularly and applying a mycotoxin risk management solution is extremely important.

Fusarium culmorum.

Table 1. Classification of mycotoxin-producing fungi in silages.

Fungi	Mycotoxin	Possible effects	Colour
Aspergillus fumigatus	Gliotoxin, Tryptoquivaline, Trypacidin	Liver and kidney damage, immune suppression, incidental abortion	Creamy yellow-(dark) green
Aspergillus flavus	Aflatoxins	Liver diseases; carcinogenic effects; haemorrhages (intestinal tract, kidneys); reduced growth rate; diminution of performance; immune suppression, transferred into the milk	Dull yellow, brownish dark green
	Cyclopiazonic acid	Necrotic effects (liver, gastrointestinal tissue, kidneys, skeletal muscles); carcinogenic; neurotoxic	
Aspergillus ochraceus	Ochratoxins	Nephrotoxic; carcinogenic; mild liver damage; enteritis; teratogenic effects; poor feed conversion; reduced growth rate; immune suppression	Yellow-pink
Fusarium spp	Trichothecenes (e.g. deoxynivalenol and T-2 toxin)	Digestive disorders (vomiting, diarrhoea, feed refusal); reduced weight gain; haemorrhages (stomach, heart, intestine, lung, bladder, kidney); oedema; oral lesions; dermatitis; blood disorders; infertility; degeneration of bone marrow; slow growth; immune suppression	Yellowish, red, brownish-red to pink or colourless
	Zearalenone	Oestrogenic effects; oedema of vulva; enlargement of uterus; atrophy of testicles; atrophy of ovaries; enlargement of mammary glands; infertility; abortion	
	Fumonisins	Pulmonary oedema; nephro- and hepatotoxic; immune suppression	
Penicillium spp	Ochratoxins	Nephrotoxic; carcinogenic; mild liver damage; enteritis; teratogenic effects; poor feed conversion; reduced growth rate; immune suppression	(Dark) green-blue to grey
	Patulin	Mutagenic; genotoxic; neurotoxic; immune suppression	
	Citrinin	Nephrotoxic; teratogenic; hepatotoxic	
Penicillium roqueforti	PR toxin	Intestinal irritation, abortion, reduced fertility	Green – blue green

Proper testing methods

Mycotoxin tests should be conducted on the feedstuffs and feed prior to feeding. An essential step in determining the mycotoxin contamination level in silages and the foundation for a high quality mycotoxin testing is proper sampling.

Mycotoxin levels within the silo vary considerably due to the inhomogeneous distribution of these toxins, so a suitable sampling procedure should be followed. It is recommended to use the guidelines according to European Commission Regulation (EC) No 401/2006 in 'laying down the methods of sampling and analysis for the official control of the levels of mycotoxins in foodstuffs'. In general, the number of incremental samples depends on the lot type (solid feed or roughages) and on the lot size.

Contamination in numbers

The latest Biomin Mycotoxin Survey covers 6,844 agricultural commodity samples from 64 countries to identify the presence and potential risk posed to livestock animal production by mycotoxins worldwide.

About 300 corn silage samples were investigated to get an insight

Continued on page 22

Continued from page 21
into the occurrence of aflatoxins (Afla), zearalenone (ZEN), deoxynivalenol (DON), T-2 toxin (T-2), fumonisins (FUM) and ochratoxin A (OTA).

The results of this study (Table 2) show that mycotoxins constitute a widespread challenge that occur under different environmental conditions across the globe. Silages are afflicted by a wide variety of mycotoxin types, and in over half of all samples, two or more mycotoxins were identified.

This multiple mycotoxin presence can be dangerous because some mycotoxins are known to have additive or synergistic negative effects on animal health.

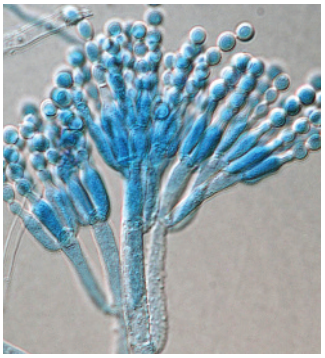
A three-pronged solution

Because groups of mycotoxins differ structurally from one another, several strategies are needed to counter the wide range of mycotoxins found in the field.

The three strategies to counteract different mycotoxins are biotransformation, adsorption and bioprotection.

Biotransformation is the most scientifically advanced and effective method available to counteract mycotoxins. It works by transforming their chemical structure, transforming them into non-toxic and environmentally-safe substances that pass through the animal without causing harm. The key advantages of biotransformation is that it is specific (targeting mycotoxins) and irreversible (cannot be undone). This mode of action targets fumonisins, trichothecenes, zearalenone and ochratoxin A.

Aspergillus sp.



Penicillium carneum.

Table 2. Biomin Mycotoxin Survey results for silage samples sourced worldwide in 2014. Fusarium toxins, such as ZEN, DON and FUM were found to be the most prevalent ones.

	Afla	ZEN	DON	T-2	FUM	OTA
Number samples tested	137	223	275	110	143	127
% of contamination	4%	68%	71%	4%	45%	6%
Average of positive (ppb)	6	290	2543	16	319	2
Maximum value found (ppb)	15	3055	13920	47.78	3939	5

Adsorption, or binding, is the most widespread and longstanding method to counteract certain adsorbable mycotoxins such as aflatoxins and ergot alkaloids.

Bioprotection relies on an innovative mix of natural ingredients to provide immune support and counter the toxic side effects caused by mycotoxins.

Conclusion

A number of common moulds found in the field produce harmful mycotoxins that impair dairy cow health and performance. The latest survey data shows that mycotoxins are quite common.

Good silage management is essential to avoid further growth of moulds and thereby prevent further mycotoxin production.

Robust mycotoxin risk management includes regular testing of feed and feedstuffs along with a multi-pronged approach to combating mycotoxins and their negative effects.

A well designed mycotoxin risk management solution program is crucial to avoid economic losses due to mycotoxins in dairy cows. ■

References are available from the author on request