

A guide to mycotoxins *in ruminants*



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INTRODUCTION

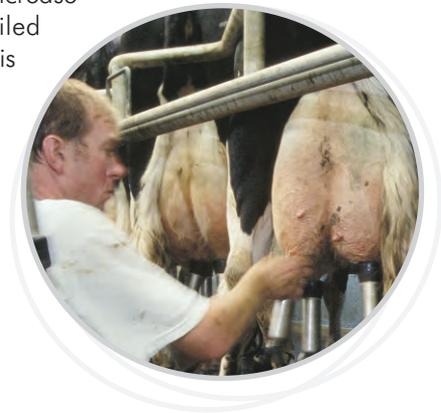
Standards of performance achieved by livestock producers are continually improving due to a combination of improved genetics, management and nutrition.

Increased productivity inevitably brings new challenges and one that has emerged in recent years, is the hidden threat posed by mycotoxins. Mycotoxins represent a risk to modern dairy and beef production that cannot be avoided, and are therefore something that all producers should understand in more depth.

Ever-present in our environment as far back as historical records go, mycotoxins have even been suggested as an explanation for the last of the Biblical Plagues. These potentially poisonous products of mould metabolism affect even the most progressive systems and strike apparently randomly, without obvious rationale.

Greater awareness of mycotoxins and the threats that they pose is an essential starting point, not least to promote management practices that minimise the presence of moulds and mycotoxins. Our understanding of the origins and effects of mycotoxins is growing. Whilst detection remains unreliable, there are now cost effective solutions to prevent and treat the consequences.

This booklet has been produced to increase awareness of, and provide detailed information on, mycotoxins. The aim is to increase knowledge, whilst directly helping to ease concerns and solve problems where appropriate.



ORIGINS AND EFFECTS OF MYCOTOXINS

What are mycotoxins?

Mycotoxins are produced naturally by all types of moulds. There are literally hundreds of different mycotoxins that we know of and it is thought that there are many more yet to be discovered.

Moulds produce mycotoxins either as defence mechanisms and/or to help the mould colonise their host organism. They are a natural means by which moulds increase their competitiveness. Moulds occur naturally throughout the environment, therefore mycotoxins are also found ubiquitously.

Mycotoxins affect animals in a wide variety of ways, and as there are many different types, diagnosis and identification is often difficult.

Whilst mycotoxins have been present ever since agriculture began, their recognition as a factor negatively affecting livestock performance is relatively new.

Mycotoxins are an increasing problem because:

- Higher performing animals are more susceptible to the effects
- Changes in the climate and in agronomic practices have created environments more suitable for mould growth
- Increased storage of feeds on farms
- Higher incidence in screening, of damaged, or broken grains
- Increased volume of grains traded globally

Lower leg swellings are amongst many varying symptoms that can indicate a mycotoxin problem in cattle



ORIGINS AND EFFECTS OF MYCOTOXINS

Common moulds and mycotoxins affecting ruminants

FUSARIUM

PENICILLIUM

ASPERGILLUS



Deoxynivalenol
Zearalenone
T-2 Toxin
Fumonisin
Fusaric Acid



PR Toxin
Patulin
Penicillic Acid
Mycophenolic Acid



Aflatoxin
Ochratoxin

**Aflatoxin is not common in northern Europe and is typically associated with hot countries, where its presence is monitored and regulated.*

How mycotoxins affect ruminant livestock

In most healthy ruminants rumen function provides a certain level of protection against some mycotoxins. However, mycotoxicosis can still prevail as the situation is not always straight-forward.

Rumen protozoa, for example, will break down *Fusarium* mycotoxins, but the extent of degradation is variable and stress factors (e.g. environmental, production, nutritional or disease) will reduce the effectiveness of this process.

No such protection is afforded against the mycotoxins produced by the mould *Penicillium roqueforti*, however, these have an anti-microbial effect, and can therefore impede rumen function and create wider problems.

Such mycotoxins with an anti-microbial effect can reduce an animal's ability to break down other mycotoxins. This explains how different mycotoxins present at low levels at the same time can work synergistically to create problems for the affected animal.

Common effects of mycotoxins in ruminants

- Variable intake
- Scouring
- Impaired immune function
- Bloody faeces
- Lower leg / teat swelling
- Muscle tremors
- General poor performance without any clear explanation
- Inconsistent milk yield
- Acidosis-type symptoms
- Poor rumen function
- Lethargy
- Reduced fertility
- Unsettled cows

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MYCOTOXINS ON THE FARM

Conditions for mycotoxin production

Moulds are highly adaptable, developing on any growing or stored feedstuff(s) in a wide variety of situations and in the same way, moulds can produce mycotoxins under a wide range of conditions. Therefore, a mycotoxin challenge should always be considered to be present but certain factors enhance the risk:

- **Plant variety:** most plant varieties are at risk from mycotoxin contamination but Bt corn has proven less susceptible.
- **Plant stress:** soil infertility, insect damage, extremes of temperature or moisture.
- **Agronomic practices:** crop rotation, soil preparation (ploughing, direct seeding).
- **Harvest stress:** late harvest, crop too dry, slow clamp filling.
- **Storage stress:** wet grain, poor clamp consolidation, poor fermentation.
- **Feed-out problems:** poor hygiene, spoilage at face, poor face management.

MYCOTOXINS ON THE FARM

Pre-harvest origins

Any growing crop, including forage and cereals, is susceptible to mould, and *Fusarium* types are the main concern as they can produce mycotoxins on the growing plant.

Whilst the moulds themselves may not survive the transition from field to feeder, the mycotoxins will remain intact, though invisible to the naked eye.

Although feeds visually and analytically appear to be of a high quality, they may still be contaminated with mycotoxins.

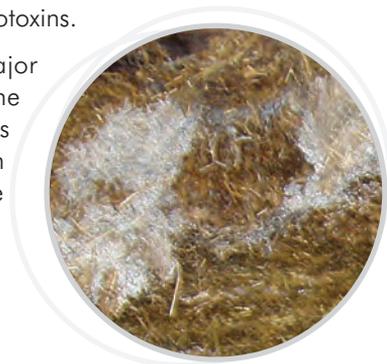


Post-harvest origins

Penicillium moulds are of greatest concern post-harvest, and in particular *P. roqueforti*. It will survive at low pH and is often the dominant mould on silage clamps, with an estimated 80% of all silages in Europe believed to be contaminated to some degree.

Mycotoxins produced by *P. roqueforti* have anti-microbial effects and will impair performance by reducing rumen function and also increase susceptibility to other mycotoxins.

Aspergillus moulds are also a major concern in hot climates, where the mycotoxin aflatoxin may be produced. As this has serious implications for human health legislation is in place to minimise its occurrence within the food chain.



MYCOTOXINS ON THE FARM

Identifying Mycotoxins

Scope for contamination:

- Any feedstuff on the farm is a potential source of mycotoxins.
- Moulds DO NOT have to be visible for mycotoxins to be present.

Testing for mycotoxins:

Feed testing is possible, but it is relatively expensive and is currently of limited effectiveness for the following reasons:

- Sampling is unreliable, as mycotoxins are not uniformly distributed in feeds.
- Mycotoxins are likely to be present in "hot spots" and not generally distributed throughout the feed.
- Only a handful of the hundreds of known mycotoxins are identified in the tests currently available.

There are currently no cow-side tests for assessing a mycotoxin challenge.

A MYCOTOXIN RISK ASSESSMENT, USING THE CHECKLIST OPPOSITE, IS THE RECOMMENDED PROCEDURE IF UNEXPLAINED POOR PERFORMANCE IS AFFECTING YOUR LIVESTOCK.

Even apparently high quality silage may contain a mycotoxin threat.



RISK ASSESSMENT AND TREATMENT

Your Mycotoxin Risk Assessment

Forages and feeds *Tick if applicable*

Are you feeding high dry matter forages?

Is there any soil contamination of/in your forage?

Is there evidence of spoilage or heating in any feeds?

Were there any unusual pre- or post-harvest weather conditions?

Has poor performance coincided with any dietary changes?

Herd health and performance

Has there been any inconsistency in milk yields?

Has there been an increase in disease incidence?

Are your cows showing symptoms of acidosis?

Have you noticed any inconsistency in dung quality?

Do you have any other unexplained concerns?

If you have ticked any of the boxes above then it is possible that your herd may be facing a mycotoxin challenge and you should take action. Contact your local Alltech representative, veterinarian or nutritionist.

RISK ASSESSMENT AND TREATMENT

Mycotoxin Action Plan

If you are having problems that you suspect might be due to mycotoxin contamination:

- 1.** Consult your vet and/or your feed adviser.
- 2.** Eliminate any other possible causes of the problems.
- 3.** Remove (or minimise the use of) any suspect or contaminated feeds.
- 4.** Ensure the total diet is geared to a fully functional rumen and a healthy cow.
- 5.** Contact your local Alltech representative.

Feeds with visible moulds are clearly a potential source of problems, but mycotoxins can be present even if the feed appears to be of top quality.



FEED STRATEGIES

Mycotoxin Adsorbents:

Speciality feed additives, known as mycotoxin adsorbents are the most common approach to prevent and treat mycotoxicoses in animals. It is believed that they bind to the mycotoxin preventing them from being absorbed. The mycotoxins and the mycotoxin adsorbent are excreted in the manure.

An effective mycotoxin adsorbent is one that prevents or limits mycotoxin absorption from the gastro-intestinal tract of the animal. In addition, it should be free from impurities and odours. Be aware that not all are equally effective. Many can impair nutrient utilisation and are mainly marketed, based on *in vitro* data only.

There are two types of mycotoxin adsorbents:

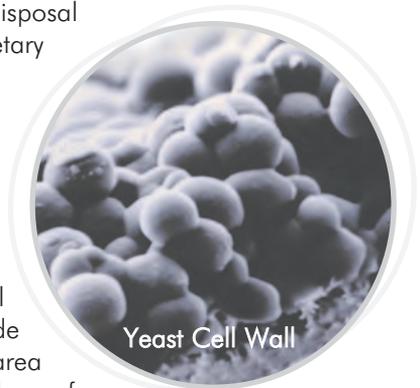
- **Inorganic** (includes zeolites, bentonites, HSCAS, clays)

These materials are often inexpensive and easy to handle. They are traditionally mixed with compound feed at a mill or mixed on farm for home mixers. Unit costs are cheap but they require a high inclusion rate in animals, taking up valuable space in the diet. Most either only adsorb specific mycotoxins, bind minerals and vitamins, cause other health complications or, due to the high inclusion rate required, are too expensive for industrial applications. However, they are also non-biodegradable and can present disposal problems when fed at high levels of dietary inclusion.

- **Organic** (includes oat hulls, wheat bran, alfalfa fibre, extracts of yeast cell wall, cellulose, hemi-cellulose, pectin)

Such materials are biodegradable but can, in some cases, also be sources of mycotoxin contamination. Benefits of specific yeast cell wall products as mycotoxin adsorbents include low inclusion levels in the diet, high surface area allowing for adsorption of a large number of mycotoxins and certainly no toxic contaminants.

The efficacy of glucomannan-containing yeast products as mycotoxin adsorbents in feeds has been investigated globally, with several studies across all animal species.



Short Term Solution:

Mycotoxin adsorbents offer an attractive short-term solution to the challenge of mycotoxin-contaminated animal feed. The only complete solution to the mycotoxin challenge will be the long-term goal of eliminating mycotoxins from the food and feed chains through improved quality control, based on better analytical techniques coupled with genetic advances in plant resistance to fungal infestation.



If you are considering adding a mycotoxin adsorbent to your feed you need to look for the following:

- Proven efficacy *in vivo* (in the animal) as well as *in vitro* (in a test tube)
- Proven efficacy by independent research bodies
- Low effective inclusion rate
- Stable over a wide pH range (this is necessary so that the mycotoxin stays attached to the adsorbent throughout the gut and is excreted.)
- High affinity to adsorb low concentrations of mycotoxins
- High capacity to adsorb high concentrations of mycotoxins
- Ability to act rapidly before the mycotoxin can be absorbed into the bloodstream.

Remember:

Above all, when you are considering using a mycotoxin adsorbent you need to be confident that the product has been proven to work in the animal in a commercial situation. It is extremely important that any *in vitro* results be supported by *in vivo* experiments relevant to the species being fed.

For more information on any of the topics covered in this booklet please contact your local Alltech representative or go to www.KnowMycotoxins.com.

If you think you may have a mycotoxin challenge please contact your veterinarian or feed nutritionist.



FURTHER INFORMATION

The Mycotoxin Blue Book; edited by Duarte E. Diaz Nottingham University Press, Manor Farm, Thrumpton, Nottingham, NG11 0AX.

Mycotoxins - are they a threat to the UK dairy industry? Wilde D., 2005, Cattle Practice Volume 13, Part 2, 131:134

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Evaluating the Impact of Mycotoxins in Europe Textbook of European Mycotoxin Seminar Series, Alltech, 2005

Ten most frequently asked questions about mycotoxins, cattle and dairy food products Whitlow, L.M. and Hagler, W.M. Jr., In: Nutritional Biotechnology in the Feed and Food Industries, Lyons, T.P. and Jacques, K.A. (Eds.) proceedings of Alltech's 20th Annual Symposium, 2004. Nottingham University Press.

For further information please contact us at:



www.alltech.com