Will the drought of 2012 cause the mycotoxin disaster of the century?

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News media have highlighted the extreme hot weather and poor rainfall in the USA. Meteorologists say that this is the biggest drought in the country since 1956 with nearly 70% of the country said to be suffering from various stages of drought and more than 30% in severe drought (CNN, July 2012).

Eroded crop conditions and crop losses along with an increase in price per bushel, are forcing the agricultural sector to import corn from other regions of the world. Global trade in agricultural commodities contributes to the concern about the mycotoxin hazard and increases awareness of potential 'imported problems'.

It is well known that fungal growth and the ability to produce mycotoxins is greatly influenced by a variety of factors like the aggressiveness of the fungal species, host susceptibility, plant and agrotechnical factors.

Also climatic and related environmental factors like soil temperature, draught stress and relative humidity play an important role.

Furthermore, moulds for example Fusarium species differ in the spectrum of toxins produced within one species. Based on these facts, it is widely accepted that naturally contaminated feed in the field can contain many different mycotoxins.

The combination of multiple mycotoxins in a feed can cause more adverse effects than a single mycotoxin due to additive or even synergistic interaction.

Synergistic effects can occur at low levels when the combined effects of two or more mycotoxins are much greater than the individual effects of each toxin alone.

Looking at recent examples of extreme weather conditions, it is very important to keep in mind that mycotoxins depend greatly upon climatic conditions, as the most important factors affecting the life cycle of all micro-organisms, including mycotoxigenic fungi, are temperature and water.

Climatic conditions

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Drought stress can occur quickly if plants are exposed to high ambient temperatures and low relative humidity.

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High temperatures, drought, poor fertilisation, and stiff competition for nutrients are some conditions known to weaken the plant's natural defence.

These conditions promote colonisation by mycotoxin-producing fungi as well as toxin production in the field.

Selecting the best possible variety of seeds for a certain location, irrigation during critical periods and balanced fertiliser application are some measures that can prevent mycotoxin contamination during plant growth.

The temperature requirements for growth and mycotoxin production differ from fungi to fungi.

In the case of deoxynivalenol, temperatures between 10 and 32°C tend to favour contamination and temperatures higher than 32°C are supposed to be safer.

Aflatoxin contamination in maize is a global concern and the major producers are

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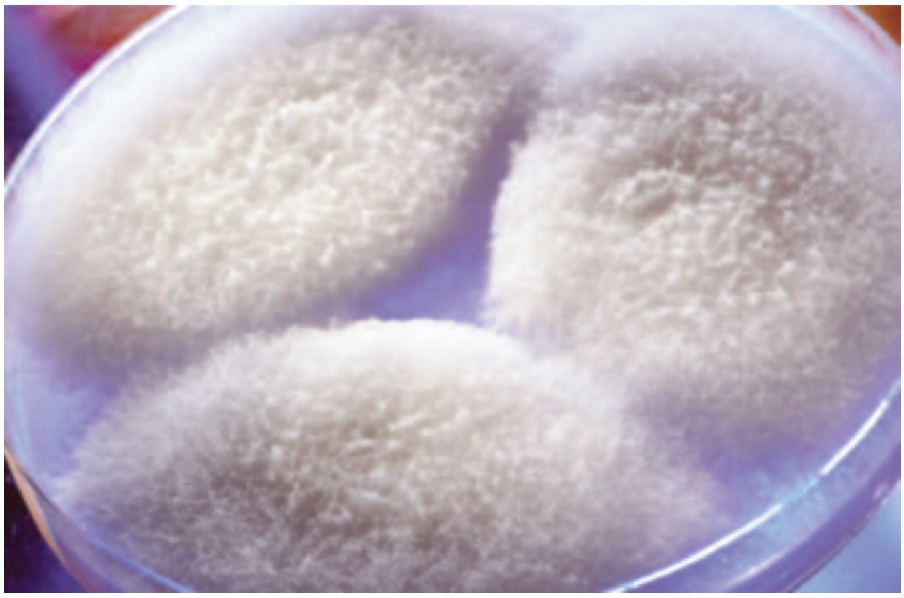
Fusarium proliferatum – one of the main producers of the mycotoxin fumonisin in grain.



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Aspergillus flavus and Aspergillus parasiticus. Heat and drought stress are known to favour the growth of these fungal species and the production of aflatoxins, as years with severe aflatoxin contamination are characterised by above average temperatures and below-average rainfall.

Fusarium proliferatum as well as Fusarium verticillioides are producers of fumonisins with fumonisin B1 being the most predominant among this group of mycotoxins.

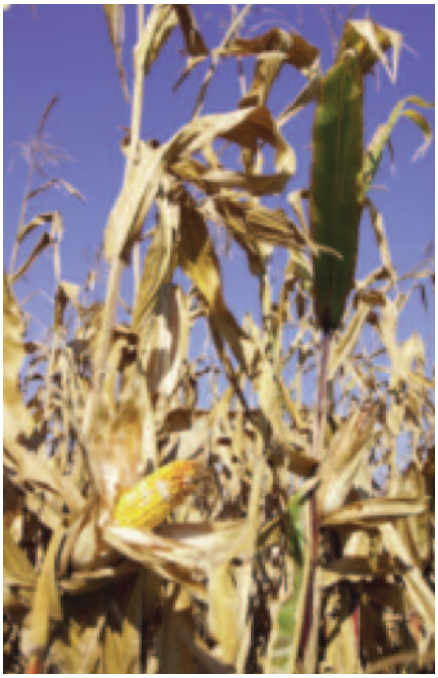
Fumonisin producing fungi can be found wherever maize is grown.

In North America, the risk of fumonisin contamination is higher in Texas and the Southeastern States, than in the Central and Midwestern States; however, fumonisins are the most common mycotoxins in the 'corn belt' states.

Mycotoxin risk management

The impact of climate conditions has been identified as an emerging issue for feed safety. This year's extreme weather conditions with high temperatures and severe drought in numerous regions will increase the presence of mycotoxins as plants become stressed and more susceptible to infections and diseases.

Heat and drought increase in particular the risk of aflatoxin contaminations. In addition, fumonisins are of great concern during warm weather. Important agricultural techniques have been developed to prevent mould growth and mycotoxin production in the field before harvest and during storage. Crop rotation, tillage, weed and insect control, and selecting the correct dates for planting and harvesting are crucial for mould infestation.



This year's extreme weather conditions are an emerging issue for feed safety.

The humidity level and temperature before and during storage need to be controlled to avoid the so-called storage mycotoxins produced by Aspergillus and Penicillium species.

Prevention strategies act in a very limited way and therefore detoxification strategies have been developed in the last three decades. A lot of research has been done to adsorb or deactivate mycotoxins in the intestinal tract of animals with products that are directly mixed into the feed.

Nevertheless, the issue of mycotoxins and mycotoxin adsorbents is a difficult one to address.

While aflatoxins and ergot alkaloids can be easily adsorbed due to their high polarity, mycotoxins such as zearalenone and trichothecenes are more difficult or even impossible to bind.

Only the combination of different strategies – adsorption, biotransformation and bioprotection – will finally lead to success in counteracting mycotoxins and reducing these toxins' negative impact on animal health and performance.

An effective and long lasting mycotoxin risk management in combination with appropriate farm management will improve the health status and consequently, the performance of animals. ■

References are available from the author on request.