ADISSEO: GREAT BRITAIN AND IRELAND 2019 MYCOTOXIN SURVEY IN WHEAT

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Introduction

Mycotoxins are poisonous secondary metabolites produced by fungi or moulds. The most significant mycotoxins are those that are present in food and/or feedstuffs as they can potentially be harmful to humans and livestock. Mycotoxins are often associated with visibly diseased or mouldy crops since they are a product of fungi. Crops may still be extensively contaminated with mycotoxins despite displaying only a few signs of disease or superficial moulds. Some food-borne mycotoxins can cause acute health symptoms which can appear almost immediately after ingestion. In contrast, delayed and cumulative health problems including carcinogenesis and immunodeficiency can be the chronic sequalae of food-borne mycotoxins. There are 5 mycotoxins or groups of mycotoxins that commonly occur in foodstuffs and feed and these include deoxynivalenol (DON)/nivalenol, zearalenone (ZEN), ochratoxin (OTA), fumonisins and aflatoxins. The mycotoxin producing fungi can be divided into 2 broad groups; those contaminating crops before harvest (commonly called field fungi) whilst those occurring after harvest (commonly called storage fungi). Ayalew (2010) postulates that there are 3 types of toxicogenic field fungi. The first group areplant pathogens such as Fusarium graminearum (DON, nivalenol). The second group comprise fungi that grow on senescent or stressed plants, such as Fusarium moniliforme (fumonisin) and sometimes Aspergillus flavus (aflatoxin).The last type are fungi that colonise plants before harvest and only propagate after harvest, such as Penicillium verrucosum (ochratoxin) and A. flavus. There are several conditions that facilitate proliferation of mycotoxins. These include poor hygienic conditions during handling, transportation and storage, high temperature, high moisture content and heavy rains (Food Nutrition and Agriculture (FAO), 1991). The 2019 Adisseo survey investigated mycotoxins originating in the field as a result of fungi.

Picture 1: Wheat harvested in Western Europe 2019

The 2019 Adisseo mycotoxin survey covered 42 wheat samples from across Great Britain and Ireland. All samples were collected directly from farms or animal feed production sites almost immediately after the harvest when there is a low probability of storage mycotoxins such as ochratoxin A (OTA) developing. Sample providers were advised to follow the principles of good sampling (Richard, 2000). Analytical personnel and/or laboratory staff were not involved, and therefore, did not influence any part of this procedure.
42 analyses were conducted to test for the presence of the 8 mycotoxins frequently found in agricultural commodities intended for animal production. The survey provided insight into the incidences of aflatoxin B^1 (AfB^1), ZEN, DON, T-2 toxin, HT-2 toxin, fumonisin B^1 (FB^1), fumonisin B_2 (FB_2) and OTA. All 8 mycotoxins were analysed by liquid chromatography tandem mass spectrometry (LC MS/MS). For the purpose of data analysis, non-detection levels were based on the limits of quantification (LOQ) of the test method for each mycotoxin: AfB_1 <0,5 µg/kg; ZEN <10 µg/kg; DON <75 µg/kg; FB_1 <125 µg/kg; FB_2 <50 µg/kg; OTA <1 µg/kg; T-2 toxin < 4 µg/kg and HT-2 toxin <4 µg/kg. Typically, the levels of DON and ZEN in wheat tend to be lower in Northern England and Scotland, moderate in Western England, Wales and Ireland and highest in Southern and South-Eastern England.

Results

The results show that 14% of wheat samples were contaminated with DON and 21% of samples were contaminated with ZEN. None of the samples contained AfB_1, T-2 toxin, FB_1 or FB_2 (Table 1). The average concentrations of all identified mycotoxins were low while the highest concentration of DON found in one of the samples reached 229 µg/kg. Only one sample was contaminated with OTA and HT-2 toxin with concentrations of 32.2 µg/kg and 8.4 µg/kg, respectively.

Table 1: Mycotoxin contamination of wheat in Great Britain and Ireland

	% of positive samples	Average concentration of positive samples (µg/kg)	Maximum concentration of positive samples (µg/kg)
Mycotoxins	Wheat		
AfB_1	LOQ	LOQ	<LOQ
DON	14	122.7	11000
ZEN	21	20.3	7500
FB_1	<LOQ	<LOQ	<LOQ
FB_2	<LOQ	<LOQ	<LOQ
T2 toxin	<LOQ	<LOQ	<LOQ
HT-2 toxin	2.3	8.4	8.4
OTA	2.3	32.2	32.2

Abbreviations: AfB_1=aflatoxin B_1; DON=deoxynivalenol; FB_1=fumonisin B_1; FB_2=fumonisin B_2; OTA=ochratoxin A; ZEN=zearalenone

The data in Table 2 suggest the contamination levels for DON and ZEN in wheat in 2019 were at their lowest levels when compared to the preceding years (2016, 2017 and 2018).

Table 2: Comparison of DON and ZEN wheat contamination in years 2016, 2017, 2018 and 2019 (>LOQ)

	2016		2017		2018		2019	
	DON	ZEN	DON	ZEN	DON	ZEN	DON	ZEN
Number of tests	73	73	88	88	50	50	42	42
% of positive	67.1	27.4	83	2.3	28	0	14	21
Average of positive [µg/kg]	373.2	52.75	222	28	69	0	122.7	20.3
Maximum [µg/kg]	1200	270	3990	20.5	131	0	229	49

Abbreviations: DON=deoxynivalenol; ZEN=zearalenone

Several samples were concurrently contaminated with 2 to 3 mycotoxins which may lead to synergistic interactions among them (Figure 1).

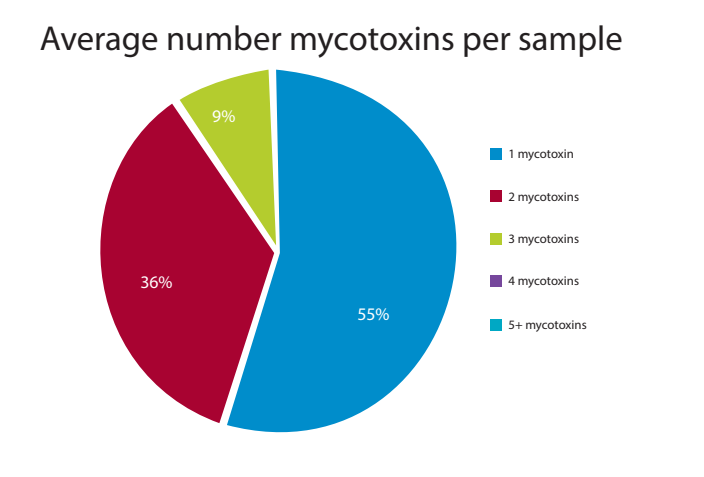

Figure 1: Average number of mycotoxins per sample

Conclusion

The Adisseo 2019 mycotoxin survey in Great Britain and Ireland concluded that the year's harvest of wheat was of very good quality in terms of mycotoxin contamination.

Compared to samples analysed from the previous years, the 2019 season's wheat crop was of higher quality. However, based on the results of this survey conducted immediately after the 2019 harvest, the 2019 wheat crop in Great Britain and Ireland should not automatically be considered safe for inclusion into finished feed rations for all animal species and a degree of vigilance is prudent.

Vigilance is always advisable as cereals in animal feeds originate from many sources. Some Central European cereals harvested in 2019 have been shown to be contaminated with medium to high concentrations of DON and ZEN. The last possible line of defense is the detoxification of mycotoxins *in vivo*.

The addition of proven mycotoxin deactivators to animal feeds is a very common method to prevent mycotoxicosis and is an effective strategy to keep mycotoxin risk low under any and all conditions.

References

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