April 2014 • Mycotoxins
A magazine of Biomin®

Mycotoxins

Science & Solutions

Surveying the threat

Mycotoxin distribution— Where & which commodity?

Mycotoxin risk levels

How safe are your animals?

A look back

The BIOMIN Mycotoxin Survey enters its 18th year.

Editorial

Right from the start

Mycotoxins have always been a topic of immense interest at BIOMIN. It was in the early 1980s that founder and chairman Erich Erber met Prof. Leibetseder, the dean of the University of Veterinary Medicine in Vienna, an enthusiastic pioneer in the field of mycotoxins who greatly impressed upon Erber the relevance of mycotoxins in feedstuffs.

When I joined BIOMIN in 1994, early concepts in mycotoxin decontamination, namely aflatoxin adsorption, were already making headway in some markets such as South-east Asia. Very soon, it was discovered that other more obscure mycotoxins, particularly the Fusarium toxins like trichothecenes and zearalenone, required different detoxification and detection strategies.

Parallel to the search for new detoxification methods, the BIOMIN Mycotoxin Survey began in 1996 with the aim of investigating the relevance of these mycotoxins in practice. Our customers were invited to send their feed samples to our laboratory for analysis. In return, they would benefit from receiving test reports confirming any contamination. With the acquisition of ROMER LABS in 1999, we were able to extend this service globally and provide laboratory tests that were certified and accredited by ISO standards.

In the latest BIOMIN survey, 4,218 samples have been tested as part of our global mycotoxin surveys. A total of about 16,300 single analyzes have been conducted, raising the awareness of mycotoxin contaminations and their relevance. BIOMIN researchers have issued more than 200 publications on this topic. Our recent Spectrum 380 program is a consolidated step towards further exploring the impact of fungal toxin contamination and its relevance for our industry.

Today, BIOMIN and its group of companies are proud to provide a holistic mycotoxins management solution—from onsite testing, high throughput reference analysis and consultancy, to protection and detoxification strategies. Having been a part of this two decades-long research, I can confidently say that our innovations have only just begun.

Eva-Maria BINDER
Vice President Research

Contents

The BIOMIN Mycotoxin Survey 2

Identifying the threats in 2013

The latest survey highlights the prevalence of the five most agriculturally relevant mycotoxins according to region and commodity.

*By **Karin Nährer** & **Paula Kovalsky***

Mycotoxin risk levels 8

Species susceptibility to mycotoxins and their respective risk levels.

Highlights from the BIOMIN Mycotoxin Survey 9

From 1996 to 2014, this historical timeline highlights the Survey's key developments and the global agricultural trends that have shaped them.

Science & Solutions is a monthly publication of BIOMIN Holding GmbH, distributed free-of-charge to our customers and partners. Each issue of **Science & Solutions** presents topics on the most current scientific insights in animal nutrition and health with a focus on one species (poultry, swine or ruminant) every quarter.
ISSN: 2309-5954

For a digital copy and details, visit: http://magazine.biomin.net
For article reprints or to subscribe to **Science & Solutions**, please contact us: magazine@biomin.net

Editor: Daphne Tan
Contributors: Eva-Maria Binder, Paula Kovalsky, Karin Nährer
Marketing: Herbert Kneissl, Cristian Ilea
Graphics: Reinhold Gallbrunner, Michaela Hössinger
Research: Franz Waxenecker, Ursula Hofstetter
Publisher: BIOMIN Holding GmbH
Industriestrasse 21, 3130 Herzogenburg, Austria
Tel: +43 2782 8030
www.biomin.net

Printed in Austria by: Johann Sandler GesmbH & Co KG
Printed on eco-friendly paper: Austrian Ecolabel (Österreichisches Umweltzeichen)

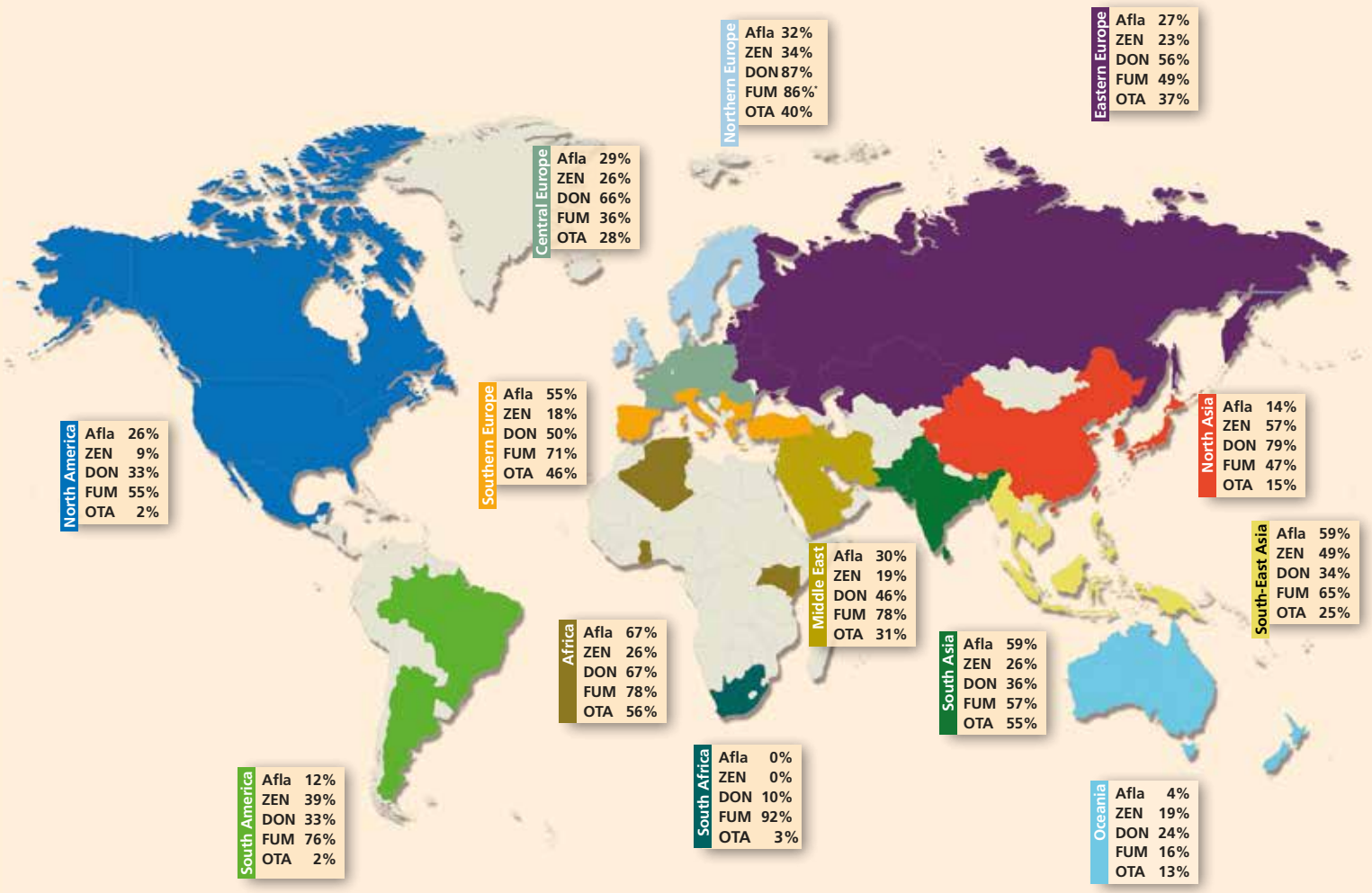
Karin Nährer
Paula Kovalsky
Product Managers
Mycotoxin Risk Management

The BIOMIN Mycotoxin Survey

Identifying the threats in 2013

Mycotoxins are a large and growing family of toxic fungal substances produced in plants intended as animal feed grains. More than 1,000 different mycotoxins have been identified so far and this number keeps growing.

Figure 1. Prevalence of mycotoxins in different geographic regions according to percentage of positive samples (>limits of quantification, LoQ).



The BIOMIN Mycotoxin Survey 2013 covers 4,218 samples from over 50 countries around the globe. More than 16,300 analyzes were conducted to test for the occurrence of the five mycotoxins most frequently found in agricultural commodities intended for animal production.

The Survey provides an insight into the incidences of aflatoxins (Afla), zearalenone (ZEN), deoxynivalenol (DON), fumonisins (FUM) and ochratoxin A (OTA) in regions across the world as well as in the primary components used for feed. These include corn, wheat, barley, rice, soybean meal, corn gluten meal, dried distillers grains (DDGS) and silage, among others.

Analysis by region

An overview of the distribution of mycotoxins by region of origin is illustrated in *Figure 1*. Once again, DON and FUM were found in over half of all samples tested worldwide. Over one-third of all tested samples were contaminated with ZEN and compared to the previous year, the number of samples positive for Afla increased by 5 percentage points to a total of 30% (*Figure 2*). In 2013, 81% of all samples contained at least one mycotoxin and 45% had more than one mycotoxin.

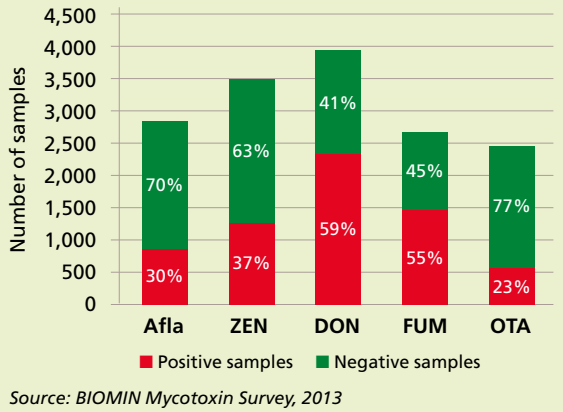
Results by region

Mycotoxins are found all over the world but their prevalence varies greatly from region to region. The following observations highlight the most important findings by region.

• Asia

Asia remained the region with highest maximum values for most of the tested mycotoxins (Afla, ZEN, DON and FUM). In total, 65% of all samples contained more than one mycotoxin and the highest incidence of ZEN was observed in this region. The highest maximum concentration of all mycotoxins was 29,267 ppb DON in a Chinese barley sample (*Table 1*).

Figure 2. Number and percentage of contaminated samples in 2013.



Source: BIOMIN Mycotoxin Survey, 2013

• Europe

The highest average OTA concentration was observed in European samples (*Table 2*). The incidence of OTA in Europe was lower compared to 2012; however, the average values are about three times higher (16 ppb). The highest concentration of OTA was found in a Spanish finished feed sample at 595 ppb OTA, which significantly exceeds the EU guidance value for complete feeding stuffs for pigs (50 ppb). The second highest maximum DON concentration (18,971 ppb) was observed in an oat sample originating from Finland. At this level, DON poses a high risk for all animal species.

• North America

In North America, FUM remained the most common mycotoxin, although the incidence was 23% lower compared to the previous year (*Table 3*). The highest worldwide average DON concentration was observed in North America (1,303 ppb). These samples would exceed the EU guidance value for complete feeding stuffs for pigs in the EU (900 ppb).

• South America

South American samples had the highest global average of ZEN at 221 ppb, a concentration that significantly exceeds the EU guidance values for complementary and complete feeding stuffs for piglets and gilts due to their high sensitivity to this estrogenic compound (*Table 4*). Also the average FUM concentration (2,422 ppb) was highest in South American samples.

• Middle East

In the Middle East, over 50% of all samples were co-contaminated with more than one mycotoxin (*Table 5*). Almost 80% of all Middle East samples tested positive for FUM and the average levels were 1,310 ppb.

• Africa

The results for African samples showed a general decline in mycotoxin occurrences compared to the previous year (*Table 6*). Despite the high prevalence of FUM in Africa (86%), the average concentration was lowest worldwide (778 ppb). However, single samples can still contain relatively high concentrations of over 4,500 ppb.

Analysis by commodity

Compared to 2012, the number of samples that tested positive for Afla (percent positive) increased by 5 percentage points in 2013 to 30%. However, the average of

Karin Nährer
Paula Kovalsky
Product Managers
Mycotoxin Risk Management

Limits of detection (LoD) →

The **LoD** shows the extreme minimum value at which an analyte can be detected. Measured values around this minimum value have a certain inaccuracy, which can be evaluated statistically. Values below this extreme value are considered non-detectable and are stated as "<LoD" in test reports.

these positive samples remained almost the same as the previous year (31 ppb). A concentration of 31 ppb Afla poses a medium risk for swine and poultry (breeders, turkeys and ducks).

There was a decrease in the number of positive samples and average concentrations for ZEN and DON compared to 2012. The maximum value of ZEN was detected in a Chinese corn sample at 5,324 ppb—a concentration level that would lead to adverse effects in all food-producing animals.

Despite the reduction in average DON concentrations to 777 ppb, this level still poses a high risk for piglets, which show the highest sensitivity to the toxin. Average FUM levels have remained similar to 2012 at about 1,400 ppb. Although the number of positive OTA samples declined to 23%, the average concentrations increased twofold to 10 ppb, which can pose a medium risk for some poultry species, such as layers, breeder, ducks and turkeys.

Results by commodity

Some of the most important commodities intended for animal feed around the globe are corn and wheat. These are therefore the most extensively tested commodities. Their occurrence by region is summarized in *Figure 4*.

African corn samples showed the highest incidence of Afla (50%), DON (80%), FUM (94%) and OTA (44%) compared to corn samples from all other regions. Asian corn samples showed the highest incidence of ZEN (45%) and also the highest average concentrations of ZEN (244 ppb) and DON (592 ppb). North American corn samples contained the highest average concentrations of Afla (61 ppb).

In South American corn samples, not only was the incidence of FUM second highest among all regions (93%) but also these samples contained the highest average level observed (3,052 ppb). With an incidence of 67%, DON is the most common mycotoxin in wheat worldwide.

[1] % of samples above the detection limit (LoD) that tested positive for the mycotoxin

[2] 1 µg/kg = ppb

Table 1. Survey results for Asia and the Pacific

North Asia (China, Japan, South Korea, Taiwan)

	Afla	ZEN	DON	FUM	OTA
Number of tests	947	983	1,001	909	920
% positive[1]	14	57	79	47	16
Average of positive (µg/kg[2])	74	179	867	1,476	5
Maximum (µg/kg)	1,563	5,324	29,267	15,576	50

South-east Asia (Malaysia, Philippines, Thailand, Vietnam, Indonesia, Myanmar, Singapore)

	Afla	ZEN	DON	FUM	OTA
Number of tests	480	480	480	480	480
% positive	59	49	34	65	25
Average of positive (µg/kg)	45	67	318	1,080	5
Maximum (µg/kg)	1,101	928	7,030	26,828	226

South Asia (Bangladesh, India, Pakistan, Sri Lanka)

	Afla	ZEN	DON	FUM	OTA
Number of tests	58	58	58	58	58
% positive	59	26	36	57	55
Average of positive (µg/kg)	51	64	327	940	17
Maximum (µg/kg)	525	295	1,960	9,562	260

Oceania (Australia, New Zealand)

	Afla	ZEN	DON	FUM	OTA
Number of tests	135	135	135	135	135
% positive[1]	4	19	24	16	13
Average of positive (µg/kg[2])	11	267	353	1,059	4
Maximum (µg/kg)	45	1,721	2,979	14,301	20

Table 2. Survey results for Europe

Northern Europe (Denmark, Finland, Norway, Sweden)

	Afla	ZEN	DON	FUM	OTA
Number of tests	31	125	127	28	25
% positive	32	34	87	86	40
Average of positive (µg/kg)	7	84	1,544	751	6
Maximum (µg/kg)	22	1,246	18,971	2,256	55

Central Europe (Austria, Belgium, Czech Republic, France, Germany, Hungary, the Netherlands, Poland, Romania, Slovakia, Slovenia)

	Afla	ZEN	DON	FUM	OTA
Number of tests	357	930	1,331	290	313
% positive	29	26	66	36	28
Average of positive (µg/kg)	9	84	789	406	11
Maximum (µg/kg)	101	3,950	12,000	3,511	238

The **LoQ** is approximately three times the value of the LoD and describes the minimum value above which the concentration of an analyte can be stated quantitatively with high precision. Results below the limit of quantification are often stated as "<numerical value" in test reports.

Limits of quantification (LoQ)

Southern Europe (Bulgaria, Croatia, Greece, Italy, Portugal, Spain, Turkey)

	Afla	ZEN	DON	FUM	OTA
Number of tests	286	306	342	231	241
% positive	55	18	50	71	46
Average of positive (µg/kg)	6	86	411	1,563	23
Maximum (µg/kg)	104	1,321	9,903	20,260	595

Eastern Europe (Russia, Ukraine)

	Afla	ZEN	DON	FUM	OTA
Number of tests	37	52	54	35	35
% positive	27	23	56	49	37
Average of positive (µg/kg)	4	205	552	1,219	3
Maximum (µg/kg)	7	670	3,166	4,750	9

Table 3. Survey results for North America (USA, Canada)

	Afla	ZEN	DON	FUM	OTA
Number of tests	160	139	155	161	85
% positive	26	9	33	55	2
Average of positive (µg/kg)	20	112	1,303	2,015	2
Maximum (µg/kg)	394	429	11,600	23,180	3

Table 4. Survey results for South America (Brazil, Argentina)

	Afla	ZEN	DON	FUM	OTA
Number of tests	234	140	123	254	47
% positive	12	39	33	76	2
Average of positive (µg/kg)	4	221	333	2,422	1
Maximum (µg/kg)	21	4,497	1,651	15,140	2

Table 5. Survey results for the Middle East (Israel, Jordan, Iraq)

	Afla	ZEN	DON	FUM	OTA
Number of tests	46	54	57	50	52
% positive	30	19	46	78	31
Average of positive (µg/kg)	5	16	206	1,310	2
Maximum (µg/kg)	15	25	843	3,487	8

Table 6. Survey results for Africa

North & sub-Sahara Africa (Algeria, Kenya, Ghana)	Afla	ZEN	DON	FUM	OTA
Number of tests	27	27	27	27	27
% positive	67	26	67	78	56
Average of positive (µg/kg)	16	56	335	1,483	2
Maximum (µg/kg)	200	154	1,368	4,593	15

South Africa	Afla	ZEN	DON	FUM	OTA
Number of tests	39	39	39	39	39
% positive	0	0	10	92	3
Average of positive (µg/kg)	-	-	212	367	1
Maximum (µg/kg)	0	0	389	1,497	1

The average DON concentration in wheat is 1,217 ppb, which is more than twice the amount found in Asian corn samples (*Table 7*).

Table 7. Survey results for the five main mycotoxins for corn (by region) and wheat (worldwide)

North America		Afla	ZEN	DON	FUM	OTA
Corn	% positive	13	9	26	59	2
	Average of pos. (µg/kg)	61	143	547	2,172	1
South America		Afla	ZEN	DON	FUM	OTA
Corn	% positive	17	38	59	93	0
	Average of pos. (µg/kg)	5	193	233	3,052	-
Europe		Afla	ZEN	DON	FUM	OTA
Corn	% positive	37	35	63	69	23
	Average of pos. (µg/kg)	12	129	941	1,904	9
Asia		Afla	ZEN	DON	FUM	OTA
Corn	% positive	37	45	70	73	12
	Average of pos. (µg/kg)	81	244	592	1,996	6
Middle East		Afla	ZEN	DON	FUM	OTA
Corn	% positive	25	14	41	100	15
	Average of pos. (µg/kg)	7	15	205	1,583	1
Africa		Afla	ZEN	DON	FUM	OTA
Corn	% positive	50	13	88	94	44
	Average of pos. (µg/kg)	4	55	298	1,455	1
Worldwide		Afla	ZEN	DON	FUM	OTA
Wheat	% positive	5	17	67	10	11
	Average of pos. (µg/kg)	2	73	1,217	587	2

- **Corn and corn by-products**

Table 8 shows the survey results by commodity for each of the five mycotoxins. Whole grain corn contained the highest average value for the sum of afla-

Karin Nährer
Paula Kovalsky
Product Managers
Mycotoxin Risk Management

Sample size and methods

Over 4,000 global samples and more than 16,000 analyzes were conducted over the period of Jan-Dec 2013 at the BIOMIN Research Center in Tulln, Austria.

Most common mycotoxin

More than half of all worldwide samples contain DON and FUM (*Figure 2*).

toxins (61 ppb). At 61 ppb of total aflatoxins, swine and poultry are at medium risk and dairy cows are at a very high risk.

Corn gluten meal (CGM) contained the highest average values for ZEN (465 ppb), FUM (3,791 ppb) and OTA (17 ppb). Also, the highest incidences of Afla (62%), ZEN (71%), FUM (94%) and OTA (40%) were observed in CGM.

It was not surprising to observe relatively high average concentrations of DON (1,241 ppb) and FUM (2,852 ppb) in DDGS, as it is known that during the production of bioethanol, many mycotoxins are concentrated in the remaining corn by-product.

- **Other cereals**

DON is the most common mycotoxin found in wheat samples with an incidence of 67%. The highest average DON concentration was detected in wheat bran samples (2,111 ppb) which is twice the level found in wheat samples.

Compared to wheat and wheat bran, rice bran samples contain higher average Afla (16 ppb) and ZEN (105 ppb) concentrations. The highest maximum level of DON was observed in a single barley sample that originated from China (29,267 ppb). The concentrations of mycotoxins in soybean meal were relatively low compared to other cereals.

Figure 4. Mycotoxin prevalence in corn

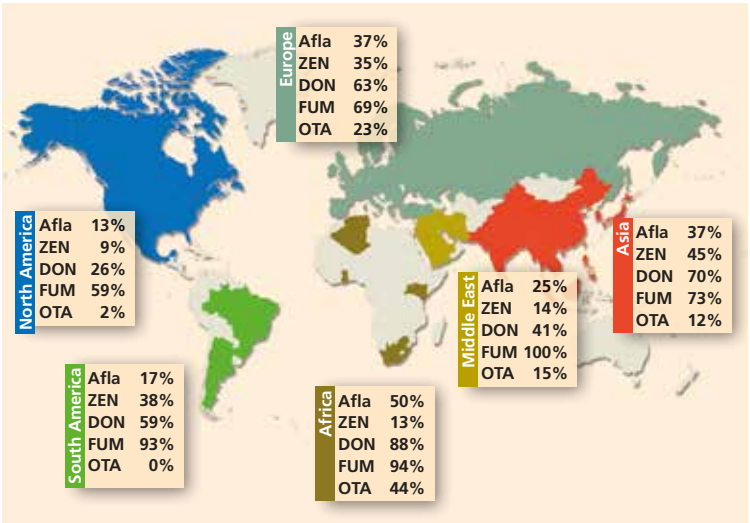


Table 8. Survey results for various feed ingredients and by-products

Whole grain corn	Afla	ZEN	DON	FUM	OTA
Number of tests	732	775	810	695	642
% above detection limits	30	36	63	73	12
Average of positive (µg/kg)	61	177	669	1,995	4
Maximum (µg/kg)	1,563	5,324	9,910	23,180	44

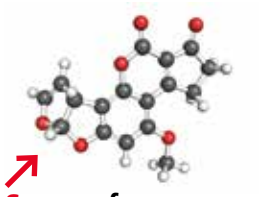
Corn gluten meal (CGM)	Afla	ZEN	DON	FUM	OTA
Number of tests	55	41	41	54	35
% above detection limits	62	71	71	94	40
Average of positive (µg/kg)	14	465	858	3,791	17
Maximum (µg/kg)	111	3,635	5,881	15,140	113

DDGS	Afla	ZEN	DON	FUM	OTA
Number of tests	58	58	59	56	52
% above detection limits	60	52	73	79	27
Average of positive (µg/kg)	9	94	1,241	2,852	13
Maximum (µg/kg)	23	434	7,030	26,828	43

Soybean meal (SBM)	Afla	ZEN	DON	FUM	OTA
Number of tests	50	55	55	52	51
% above detection limits	16	22	11	15	12
Average of positive (µg/kg)	2	27	428	226	2
Maximum (µg/kg)	6	99	1,680	549	4

Wheat	Afla	ZEN	DON	FUM	OTA
Number of tests	264	382	501	261	261
% above detection limits	5	17	67	10	11
Average of positive (µg/kg)	2	100	1,070	746	3
Maximum (µg/kg)	8	892	12,000	3,687	14

Illustration: petarg_shutterstock



Survey focus

Aflatoxins, zearalenone, deoxynivalenol, fumonisins and ochratoxin A are among the most frequently occurring mycotoxins worldwide. These five mycotoxins are therefore covered in the BIOMIN Mycotoxin Survey.

Most problematic ingredient

Corn was found to contain the highest concentrations of singly occurring Afla and ZEN, in addition to the highest levels of FUM in corn DDGS.

Wheat bran	Afla	ZEN	DON	FUM	OTA
Number of tests	57	63	56	58	47
% above detection limits	2	44	95	21	21
Average of positive (µg/kg)	2	28	2,111	336	2
Maximum (µg/kg)	2	91	11,008	610	4

Rice bran	Afla	ZEN	DON	FUM	OTA
Number of tests	33	33	33	33	32
% above detection limits	42	64	42	42	31
Average of positive (µg/kg)	16	105	141	219	2
Maximum (µg/kg)	96	337	547	533	12

Barley	Afla	ZEN	DON	FUM	OTA
Number of tests	60	208	342	56	57
% above detection limits	7	15	68	9	9
Average of positive (µg/kg)	21	66	1,183	844	2
Maximum (µg/kg)	82	253	29,267	2,022	3

Finished feed	Afla	ZEN	DON	FUM	OTA
Number of tests	1,006	1,163	1,296	945	799
% above detection limits	40	48	60	72	36
Average of positive (µg/kg)	18	89	469	950	15
Maximum (µg/kg)	1,165	2,667	9,903	10,282	595

Corn silage	Afla	ZEN	DON	FUM	OTA
Number of tests	151	214	231	131	121
% above detection limits	5	41	58	47	14
Average of positive (µg/kg)	3	186	566	668	2
Maximum (µg/kg)	6	3,950	5,905	4,288	9

- **Finished feed and silage**

As corn is one of the main components of finished feed, the most common mycotoxins, FUM and DON, were found at almost similar levels in both finished feed and corn samples. However, a lower percentage of finished feed samples tested positive for all mycotoxins except for OTA. Accordingly, the highest maximum OTA concentration was observed in a single finished feed sample (595 ppb). This level exceeds ten-times the EU guidelines for OTA in complete feedingstuffs for pigs (50 ppb) and would pose a high risk for all livestock animals.

The average mycotoxin concentrations in corn silage samples were very similar to those observed for finished feed. The most common mycotoxin in corn silage samples was DON with a prevalence of 55% and an average concentration of 398 ppb, which poses a high risk for piglets.

Mycotoxins—a global concern

The analysis of the 4,218 samples in this survey gives a clear picture of why mycotoxins are a topic of concern in animal feed. Multi-mycotoxin occurrences continue to be a global threat. Constant monitoring and continual research on the prevention and mitigation of mycotoxin contamination are therefore necessary.

Co-occurrence

In 45% of all samples, more than one mycotoxin was detected. Multi-mycotoxin occurrence is a challenge due to its potential synergistic effects in animals.

Distinct mycotoxin patterns can also be observed in each commodity due to the individual plant's susceptibility to fungal infection and subsequent mycotoxin contamination. Therefore, the analysis of different commodities from various regions is essential to obtain a clearer understanding of the worldwide occurrence of these fungal toxins.

A first step towards preventing the negative effects of these harmful substances is the use of good agricultural practices and proper storage conditions. An effective mycotoxin risk management program is also essential in order to protect animals from the effects that mycotoxins have on health and performance.

As part of its approach towards mycotoxin risk management, BIOMIN provides yearly regional insights and analysis on the prevalence of the most important mycotoxins in primary feedstuffs.

Karin Nährer
Paula Kovalsky
Product Managers
Mycotoxin Risk Management

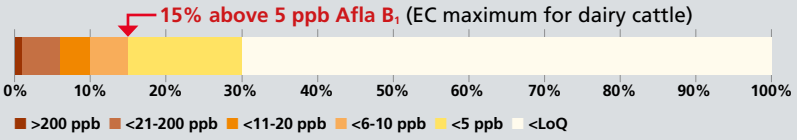
Mycotoxin risk levels

The BIOMIN Mycotoxin Survey also determines the risk levels of the mycotoxins analyzed according to the percentage of samples in the different contamination ranges and based on total daily feed intake (*Figure 1*). These ranges represent the different mycotoxin risk levels for various animal species (yellow: low risk level, to red: high risk level). They also take into account the European Commission regulation and recommendation on the threshold level for mycotoxins.

Figure 1. Afla, ZEN, DON, FUM and OTA risk levels for poultry, pig and dairy cattle (% of all samples tested).

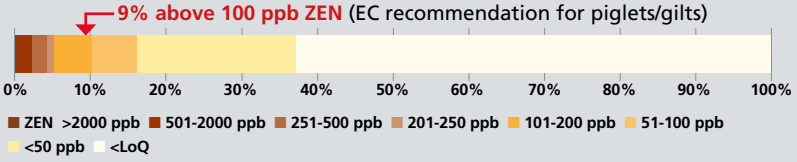
6% Samples with **Afla** level >20 ppb.
Medium risk

15% Samples considered
High risk



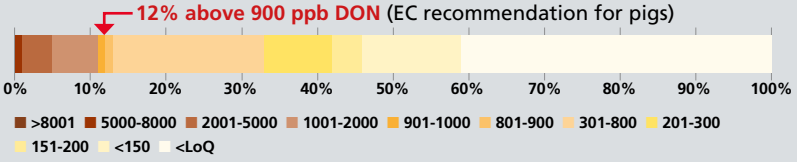
16% Samples with **ZEN** level >50 ppb.
Borderline-to-medium risk

5% Samples considered
High risk

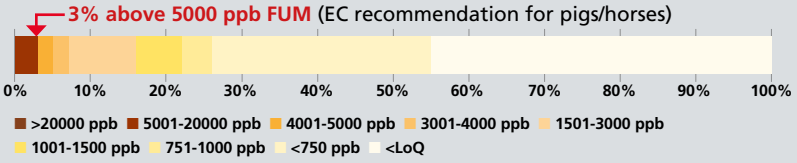


33% Samples with **DON** level >300 ppb.
High-to-medium risk

12% Samples above the EU guidance values for complementary and complete (900 µg/kg). ***High risk***

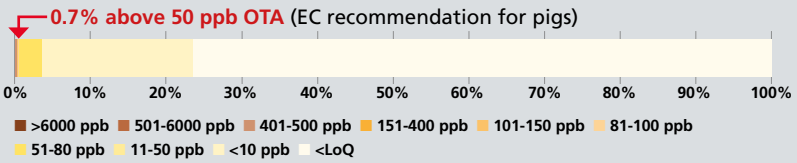


21% Samples with **FUM** level >1000 ppb.
Medium-to-high risk



77% Samples with **OTA** level below the LoD

0.7% Samples above the EU guidance values for complementaryand complete feedingstuffs (OTA 50 ppb).



The above tables should be considered a rough recommendation. The negative impact depends not only on the level and type of mycotoxin contamination but also on the general health status of the animal and environmental conditions. All levels of mycotoxins should be considered unsafe and increased levels carry increased risks to animal health. Low levels of mycotoxin ingestion can have a detrimental effect on the immune system and are a hindrance to optimal performance.

Distribution of mycotoxins according to risk levels

Field mycotoxins such as DON, FUM and ZEN were the most frequently occurring worldwide. The survey determined the risk levels of these mycotoxins according to the percentage of samples in the different contamination ranges. The main result from this survey was the presence of the type B-trichothecene DON in 42% of all the surveyed samples at contamination levels above 300 µg/kg.
In total, 12.5% of all the feed samples were above the EU guidance values for DON (900 µg/kg) in complementary and complete feedstuffs for pigs (EC, 2006).

Highlights from the BIOMIN Mycotoxin Survey

1996

- **BIOMIN launches the Mycotoxin Survey**

2005

Global trend:
The first analysis for Afla started with 45 ppb in 2005. Afla levels have been climbing steadily ever since

2008

- **The complete BIOMIN Mycotoxin Survey is published in four different magazines**

Peak in worldwide positive DON samples (64%), especially in Europe (68%) and North Asia (77%)

2010

- **BIOMIN publishes a paper: 'Occurrence of mycotoxins in Southern Europe'**
  World Mycotoxin Journal, August 2010

DON and ZEN affect North American crops. DON found in 87% of tested samples at worrying average levels (1,487 ppb)

- **LC-MS/MS multi-screen method available for specific field samples**

2012

- **BIOMIN publishes a paper: 'A three-year survey on the worldwide occurrence of mycotoxins in feedstuffs and feed'**
  Toxins 2012

Record Afla level of (6,323 ppb) found in a groundnut cake from Myanmar

2013

- **The Mycofix app allows instant access to worldwide data on mycotoxin occurrences and information on possible mycotoxin risks**

Afla scandal in southern and central Europe: Up to 44 – 55% (southern Europe) and 19 – 20% (central Europe) of samples contaminated

- **BIOMIN publishes a paper: 'Multi-mycotoxin screening reveals 139 different secondary metabolites in feed and feed ingredients'**
  Toxins 2013; doi:10.3390/toxins5030504

- **BIOMIN publishes a paper: 'Mycotoxin occurrence in feed and feed raw materials worldwide'**
  J Sci Food Agric 2013

Severe drought 2012 in the US corn belt lead to high FUM and very high Alfa levels

2002

- **The first article from the BIOMIN Mycotoxin Survey published in Focus Asia**

2007

- **BIOMIN publishes a paper: 'Worldwide occurrence of mycotoxins in commodities, feeds and feed ingredients'**
  Animal Feed Science and Technology, 2007

Global trend: FUM found in 80% of North Asia samples. Record levels of DON (50,289 ppb) found in an Austrian wheat sample and ZEN (26,728 ppb) in an Australian silage sample

- **Afla first surveyed in Europe**

2009

- **First quarterly Mycotoxin Survey available Personal mycotoxin risk management tool was created**

Increase in ZEN-positive samples in finished feed at 78%. High Afla level (183 ppb)

2011

- **BIOMIN publishes a paper: 'A comprehensive survey on the occurrence of mycotoxins in maize DDGS sourced worldwide'**
  World, Mycotoxin Journal, February 2012

The 2010 floods in Australia brought record levels of ZEN and DON to wheat samples

Maximum levels 77,502 ppb FUM and 1,589 ppb OTA were found in a Chinese finished feed sample

- **BIOMIN publishes a paper: 'Mycotoxin occurrence in commodities, feeds and feed ingredients sourced in the Middle East and Africa'**
  Food Additives and Contaminants: Part B

- **BIOMIN publishes a paper: 'Mycotoxins in Silages: Occurrence and Prevention'**
  Iranian Journal of Animal Science, 2011

2014

- **Spectrum® 380: Multi-mycotoxin analysis capable of determining over 380 different mycotoxins simultaneously. This method is now available for routine analysis at IFA Tulln** (Interuniversity Department for Agrobiotechnology) **in cooperation with BIOMIN**

- **New app available in English and Chinese**

Did you know...

...that erratic weather patterns are challenging quality issues in China's northern corn belt?

Find out how mycotoxins are affecting the corn harvest in China, in this Hot Topic from our mycotoxins desk

Mycofix®

Leading. Proven. Authorized.

Mycofix® is the only EU-authorized feed additive proven to counteract mycotoxins.

Yet another proof of solid R&D that has set BIOMIN as the clear innovation leader in mycotoxin risk management.

mycofix.biomin.net

Naturally ahead

Biomin®