

BIOMIN

World Mycotoxin

Survey 2018

Annual Report No. 15



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Naturally ahead

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BIOMIN World Mycotoxin Survey 2018

World overview

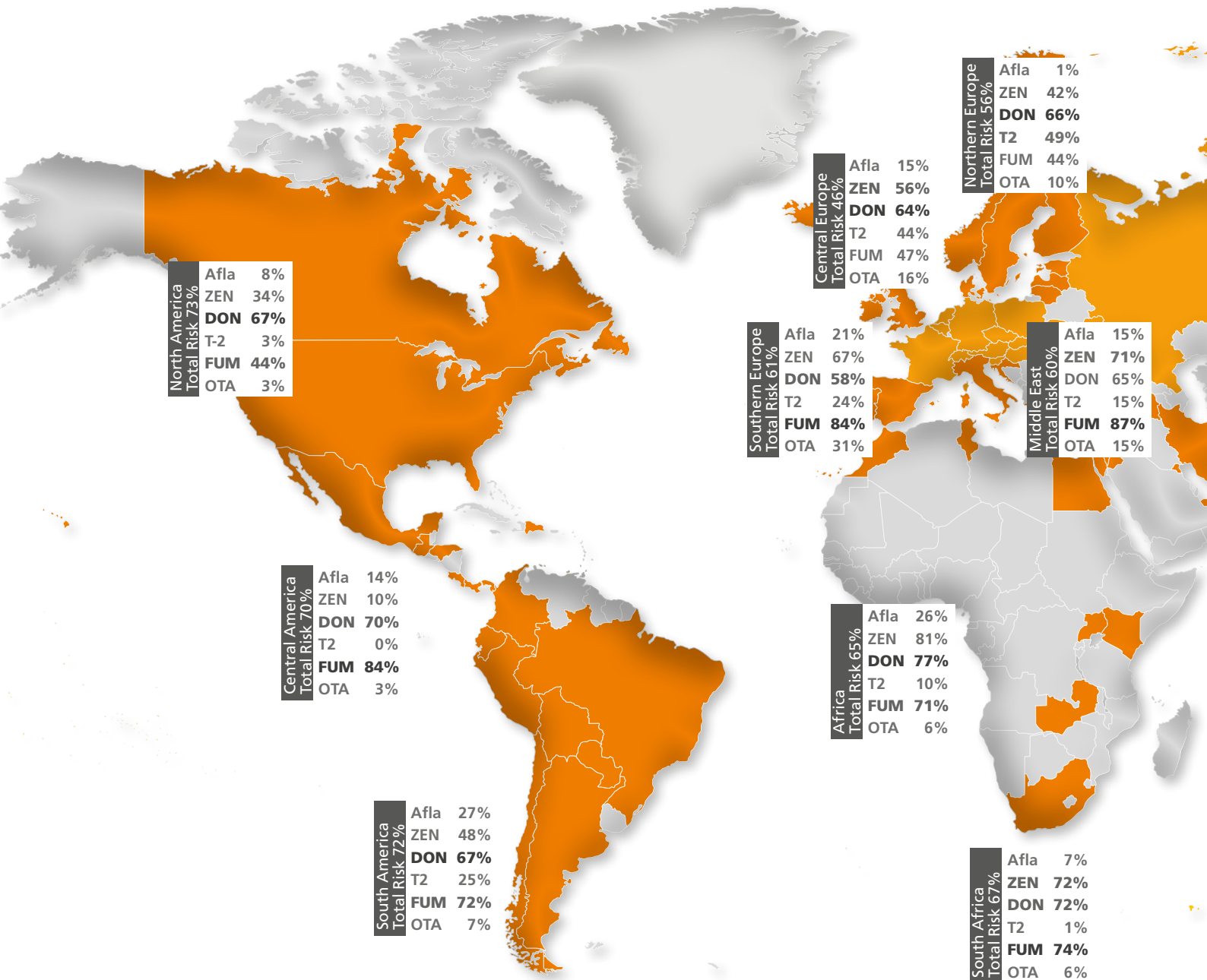
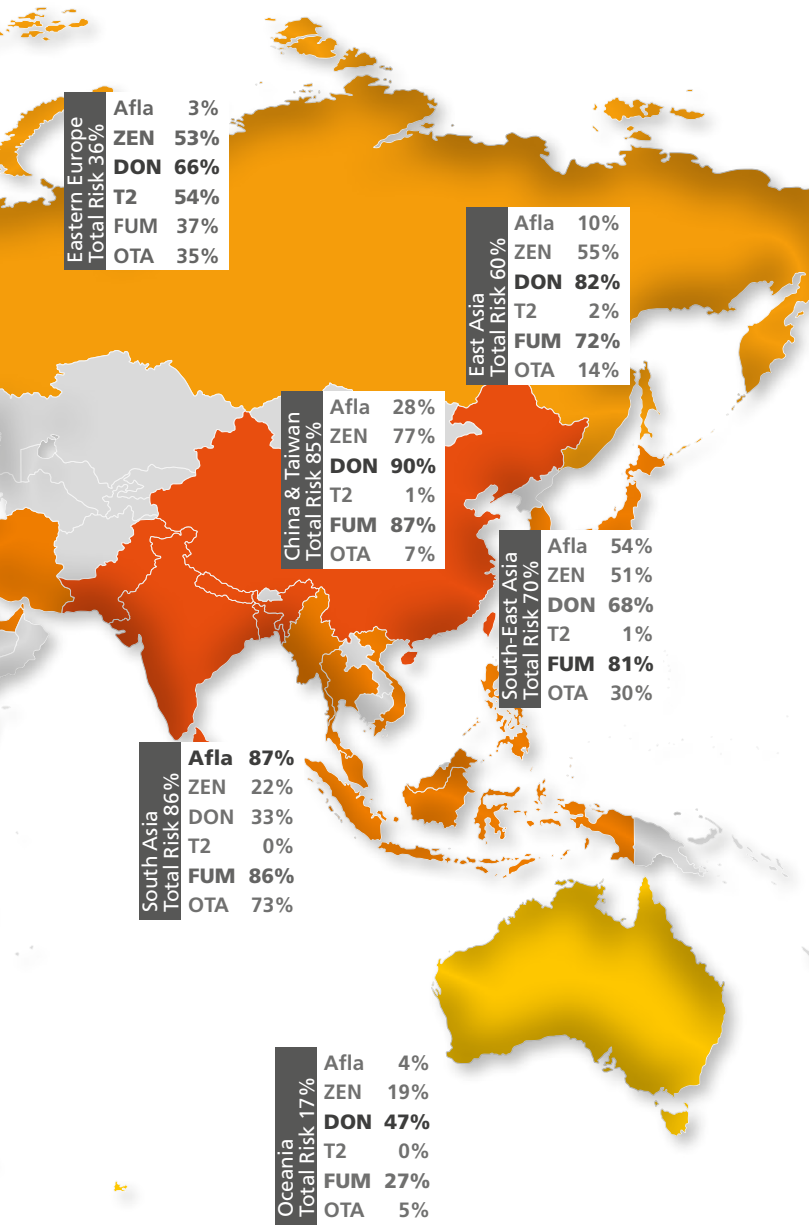


Figure 1. Global map of mycotoxin occurrence and risk in different regions.

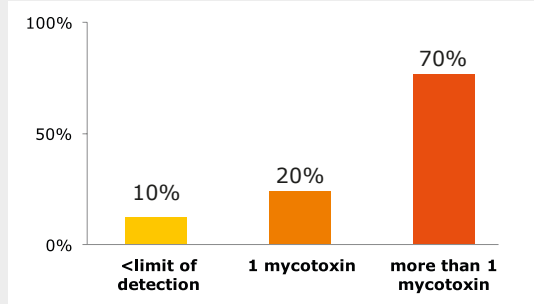
Legend

- Moderate risk: 0 – 25% of samples above risk threshold
- High risk: 26 – 50% of samples above risk threshold
- Severe risk: 51 – 75% of samples above risk threshold
- Extreme risk: 76 – 100% of samples above risk threshold
- No samples tested



Samples **Analyses** **Countries**

Co-contamination



Number of mycotoxins per sample based on samples tested for 3 or more mycotoxins.

Risk Level

The risk level expresses the percentage of samples testing positive for at least one mycotoxin above the threshold level in parts per billion (ppb). A severe risk level indicates that >50% of samples may represent a risk to productivity or disease susceptibility.

Recommended risk threshold of major mycotoxins in ppb

Afla	ZEN	DON	T-2	FUM	OTA
2	50	150	50	500	10

DISCLAIMER

BIOMIN GmbH and the authors had no influence on the sampling process of the investigated samples. Therefore, the contamination levels found in the samples do not necessarily reflect the actual contamination level of these regions/commodities. However, the samples provide more insight into the range and levels of mycotoxins which can be found in diverse commodities of various regions. Mycofix® is not available in the US and Canada.

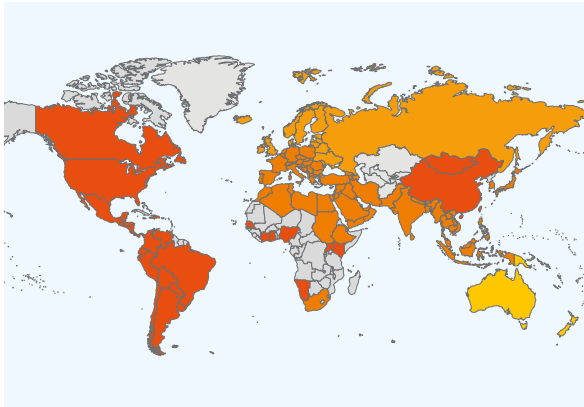
ACKNOWLEDGEMENTS

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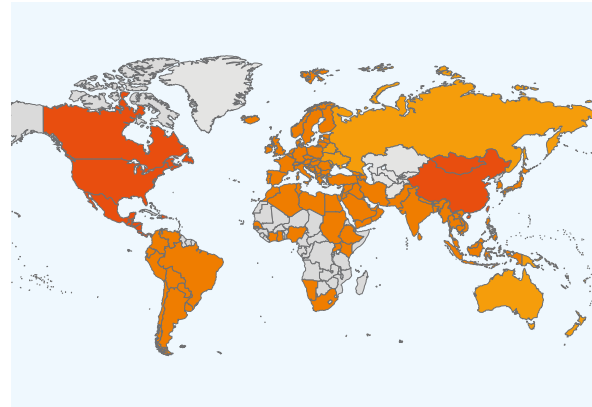
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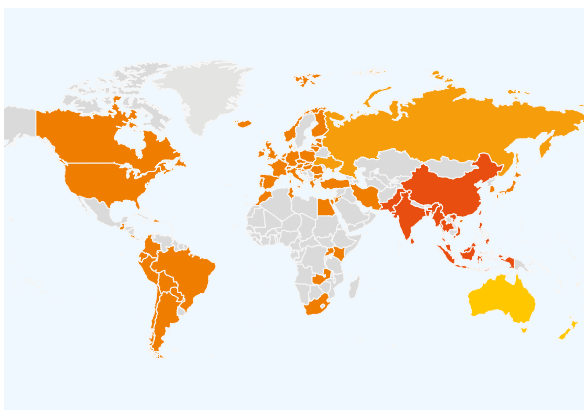
Mycotoxin trends



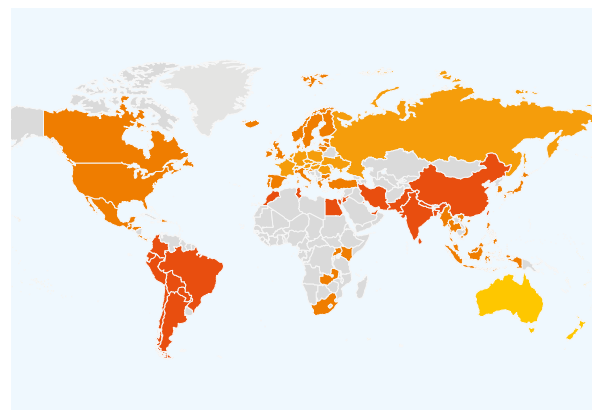
January - June 2017



July - December 2017



January - June 2018

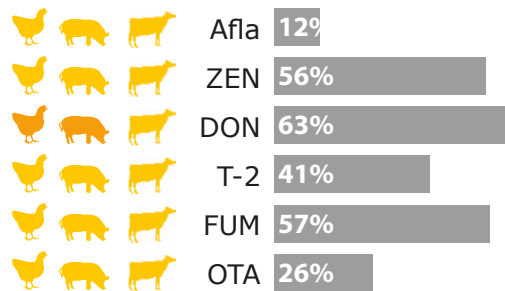
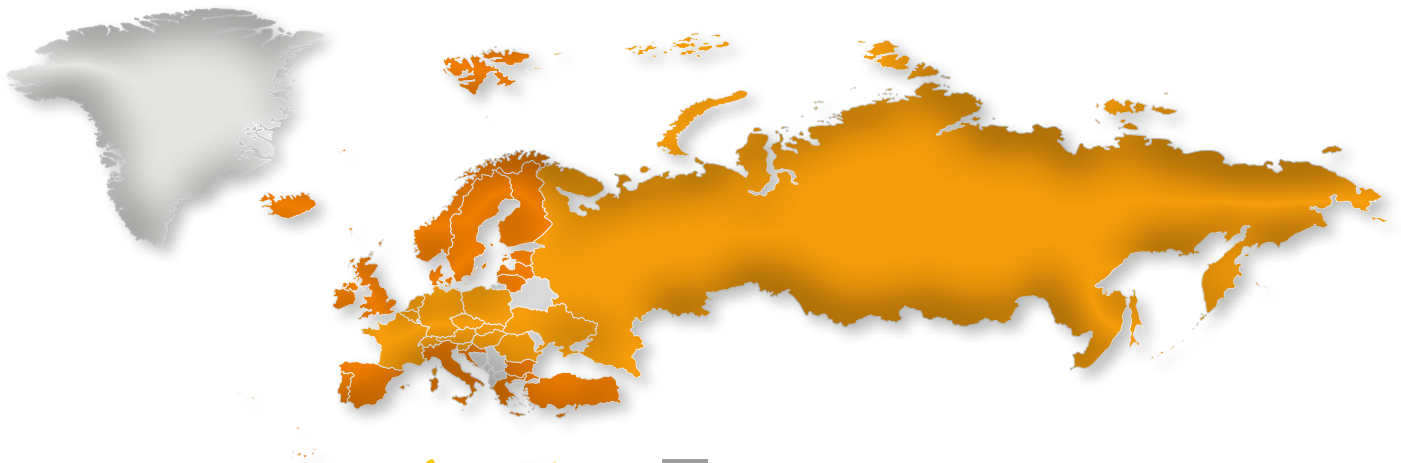


July - December 2018

A regional overview

Changes in risk for half year from 2017 to 2018 indicate the changes that happen with the main crop harvests. A slight decrease in risk can be seen for South America during the year 2017. For North America, risk also seemed to lighten from 2017 to 2018. China and Taiwan show an extreme risk

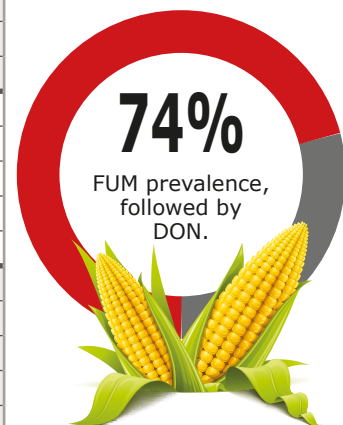
throughout the semesters. Interestingly, risk changed to extreme in South and South East Asia. In the second semester of 2018 also South America and Middle East had to increase the risk level from severe to extreme.



Colours of the animals indicate the species risk assessment according to legend on page 2 and % of positive samples

Mycotoxins in main commodities

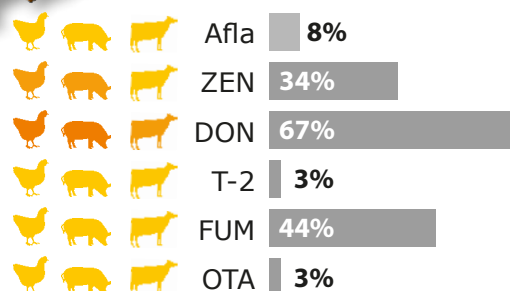
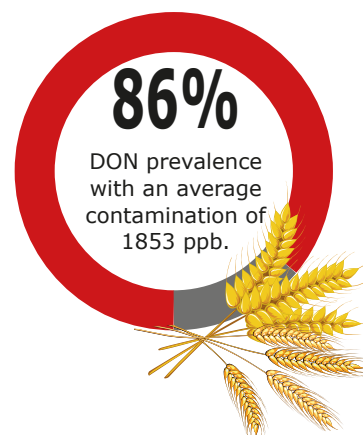
	Total samples: 4 392	Afla	ZEN	DON	T-2	FUM	OTA
Finished feed	Number of samples tested	1146	1447	1472	1256	1174	1184
	% Contaminated samples	12%	77%	71%	42%	78%	40%
	Average of positives (ppb)	5	30	249	30	512	4
	Median of positives (ppb)	2	15	131	10	159	2
	Maximum (ppb)	136	1420	8559	721	26204	90
Corn	Number of samples tested	371	537	571	364	462	359
	% Contaminated samples	18%	51%	65%	44%	74%	13%
	Average of positives (ppb)	9	76	816	266	1540	156
	Median of positives (ppb)	2	25	348	49	550	2
	Maximum (ppb)	76	2056	40700	6062	26114	5912
Cereals*	Number of samples tested	743	1372	1503	987	760	770
	% Contaminated samples	11%	38%	59%	47%	25%	12%
	Average of positives (ppb)	2	40	912	35	206	19
	Median of positives (ppb)	1	25	280	20	77	3
	Maximum (ppb)	19	615	22984	2113	2354	569



*Cereals: wheat, barley, oats, rice, sorghum, millet.

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North America

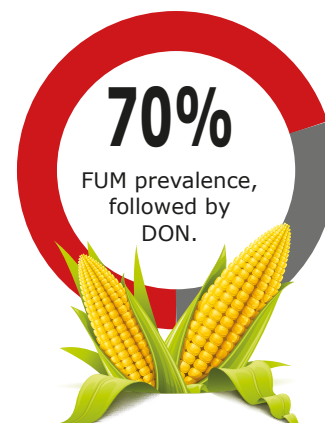


Colours of the animals indicate the species risk assessment according to legend on page 2 and % of positive samples

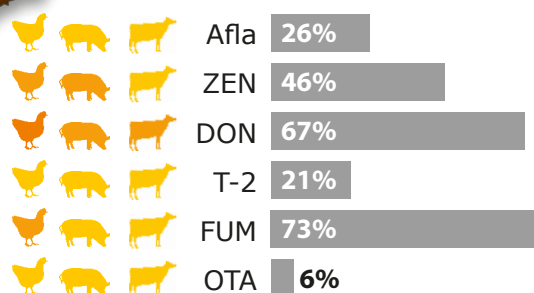
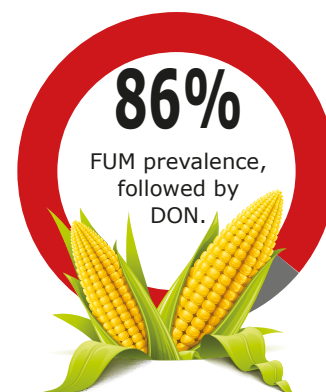
Mycotoxins in main commodities

	Total samples: 1 780	Afla	ZEN	DON	T-2	FUM	OTA
Finished feed	Number of samples tested	537	578	492	492	563	578
	% Contaminated samples	12%	29%	82%	5%	46%	3%
	Average of positives (ppb)	9	147	579	697	2673	3
	Median of positives (ppb)	4	85	321	664	708	2
	Maximum (ppb)	57	1282	6500	1143	50734	7
Corn	Number of samples tested	478	484	450	450	483	484
	% Contaminated samples	9%	36%	68%	2%	70%	1%
	Average of positives (ppb)	36	297	759	379	3497	8
	Median of positives (ppb)	15	145	428	545	1236	4
	Maximum (ppb)	280	3320	13641	898	76778	18
Cereals*	Number of samples tested	48	51	51	50	51	52
	% Contaminated samples	6%	55%	86%	6%	33%	12%
	Average of positives (ppb)	6	369	1853	67	534	3
	Median of positives (ppb)	7	71	645	2	467	2
	Maximum (ppb)	8	4765	11600	197	1330	4

*Cereals: wheat, barley, oats, rice, sorghum.



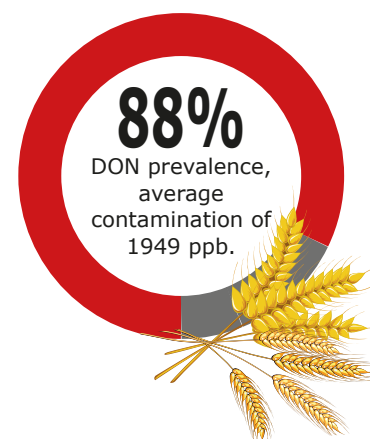
South & Central America



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Mycotoxins in main commodities

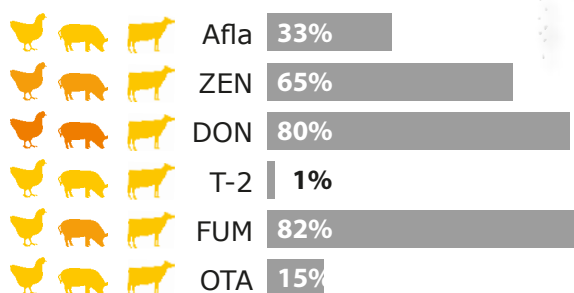
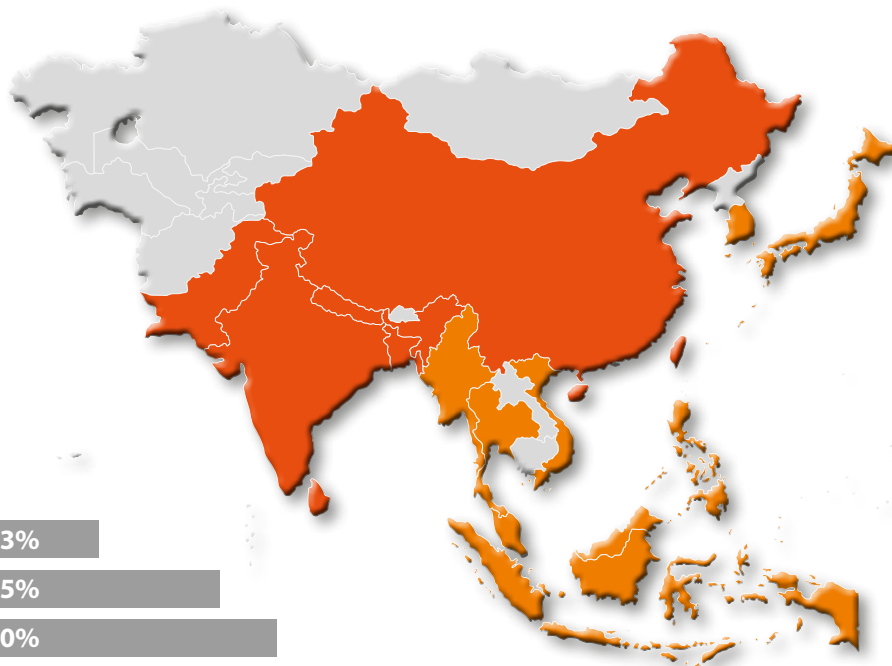
	Total samples: 8 146	Afla	ZEN	DON	T-2	FUM	OTA
Finished feed	Number of samples tested	1033	1048	1236	737	1400	535
	% Contaminated samples	25%	35%	66%	12%	89%	2%
	Average of positives (ppb)	9	85	534	39	1107	5
	Median of positives (ppb)	4	44	440	41	728	3
	Maximum (ppb)	216	1504	3850	69	44482	22
Corn	Number of samples tested	3656	2943	2540	921	3092	395
	% Contaminated samples	19%	35%	63%	11%	86%	7%
	Average of positives (ppb)	11	150	564	40	2636	13
	Median of positives (ppb)	4	54	430	29	1260	3
	Maximum (ppb)	402	5020	6800	293	72100	75
Cereals*	Number of samples tested	586	388	326	232	337	71
	% Contaminated samples	53%	61%	88%	34%	31%	11%
	Average of positives (ppb)	5	171	1949	32	509	8
	Median of positives (ppb)	4	87	1610	30	300	4
	Maximum (ppb)	40	1648	8750	92	4382	39



*Cereals: wheat, barley, oats, rice, sorghum.

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Asia

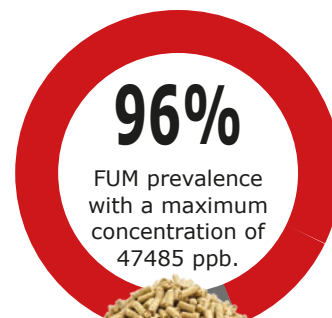
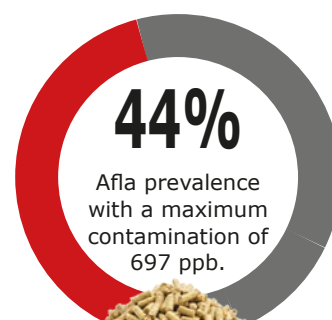


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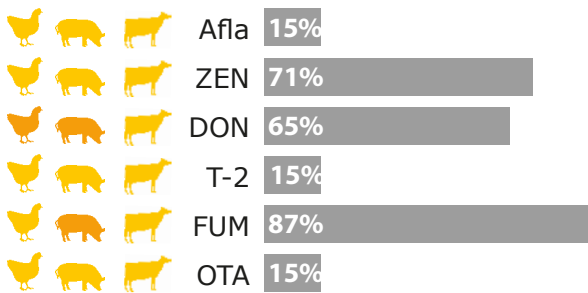
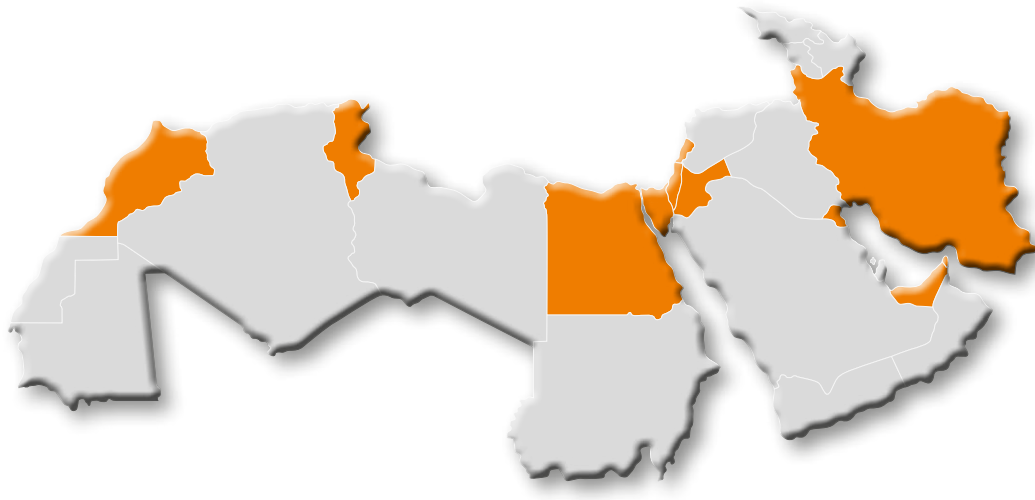
Mycotoxins in main commodities

	Total samples: 3 374	Afla	ZEN	DON	T-2	FUM	OTA
Finished feed	Number of samples tested	1458	1466	1467	1449	1458	1449
	% Contaminated samples	44%	79%	89%	1%	96%	21%
	Average of positives (ppb)	26	75	315	15	1204	6
	Median of positives (ppb)	8	34	245	14	675	2
	Maximum (ppb)	697	2141	6126	23	27352	124
Corn	Number of samples tested	685	685	686	579	678	579
	% Contaminated samples	37%	66%	86%	1%	96%	4%
	Average of positives (ppb)	42	161	514	28	2950	8
	Median of positives (ppb)	8	36	355	23	1250	5
	Maximum (ppb)	636	6218	7632	71	47485	58
Cereals*	Number of samples tested	267	267	267	245	267	245
	% Contaminated samples	13%	40%	73%	0%	40%	6%
	Average of positives (ppb)	13	117	2094	12	666	3
	Median of positives (ppb)	1	69	626	12	44	2
	Maximum (ppb)	188	1205	53796	12	11460	7

*Cereals: wheat, barley, rice, sorghum.



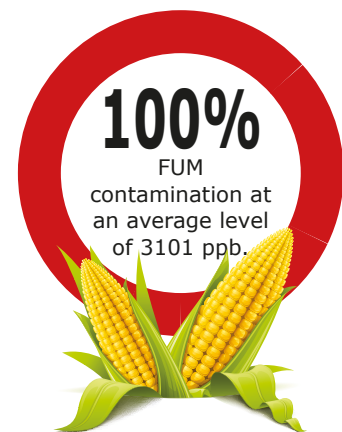
Middle East



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Mycotoxins in main commodities

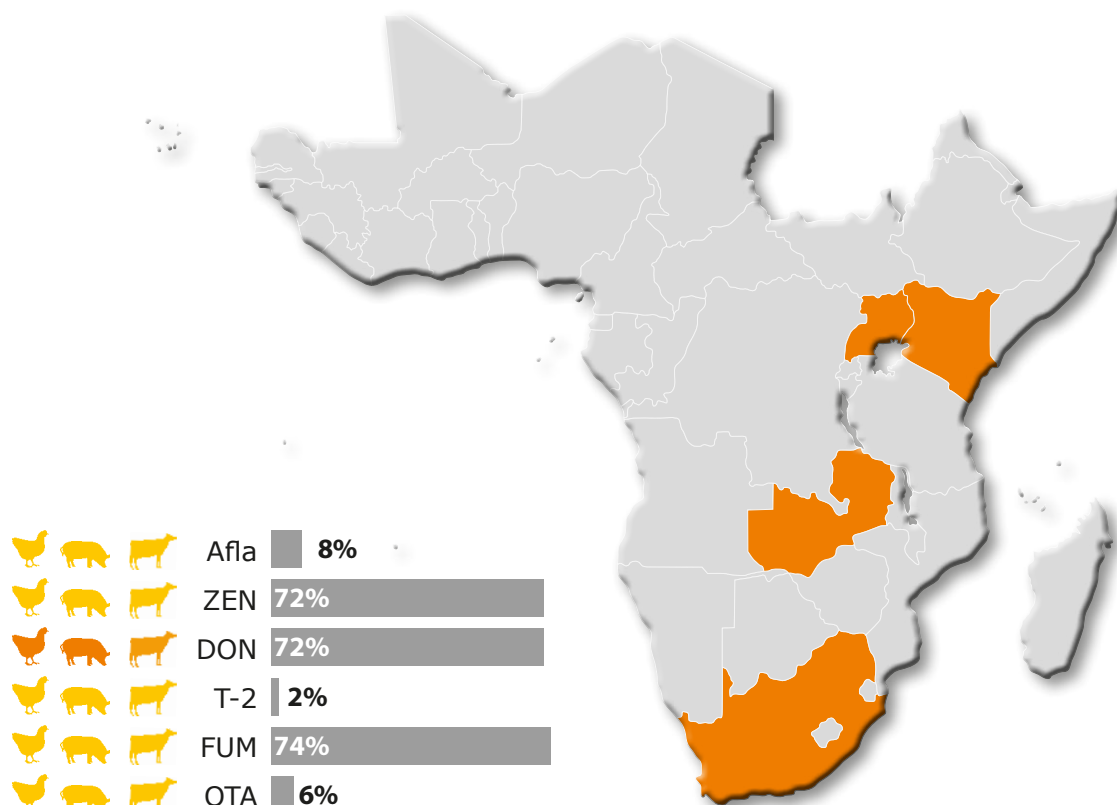
	Total samples: 176	Afla	ZEN	DON	T-2	FUM	OTA
Finished feed	Number of samples tested	87	87	94	89	94	83
	% Contaminated samples	11%	92%	82%	18%	97%	17%
	Average of positives (ppb)	3	34	207	14	989	2
	Median of positives (ppb)	2	25	173	12	349	1
	Maximum (ppb)	15	282	650	37	9640	4
Corn	Number of samples tested	14	17	18	16	19	15
	% Contaminated samples	29%	71%	89%	19%	100%	20%
	Average of positives (ppb)	2	39	298	13	3101	0
	Median of positives (ppb)	1	27	242	11	1503	0
	Maximum (ppb)	6	148	638	20	14427	0
Cereals*	Number of samples tested	8	8	8	7	8	7
	% Contaminated samples	13%	63%	50%	14%	75%	14%
	Average of positives (ppb)	2	33	537	20	795	5
	Median of positives (ppb)	2	21	501	20	449	5
	Maximum (ppb)	2	75	1050	20	2289	5



*Cereals: wheat, barley

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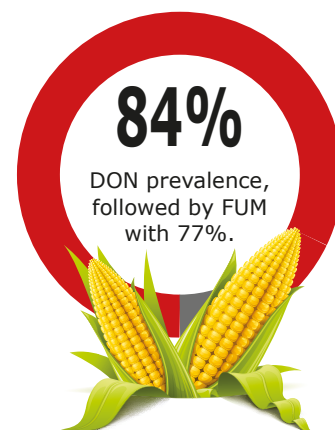
Africa



Colours of the animals indicate the species risk assessment according to legend on page 2 and % of positive samples

Mycotoxins in main commodities

	Total samples: 494	Afla	ZEN	DON	T-2	FUM	OTA
Finished feed	Number of samples tested	161	157	157	157	157	157
	% Contaminated samples	11%	91%	89%	4%	96%	2%
	Average of positives (ppb)	9	46	719	12	291	1
	Median of positives (ppb)	4	13	317	10	122	0
	Maximum (ppb)	26	946	10932	34	2706	2
Corn	Number of samples tested	191	191	191	191	191	191
	% Contaminated samples	3%	72%	84%	1%	77%	2%
	Average of positives (ppb)	3	71	741	26	640	6
	Median of positives (ppb)	2	19	454	26	253	0
	Maximum (ppb)	8	2314	12220	26	9373	25
Cereals*	Number of samples tested	28	28	28	28	28	28
	% Contaminated samples	21%	86%	21%	4%	86%	0%
	Average of positives (ppb)	8	68	1227	22	423	-
	Median of positives (ppb)	4	11	714	22	278	-
	Maximum (ppb)	27	1176	3891	22	2314	0



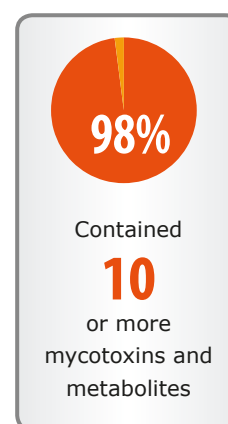
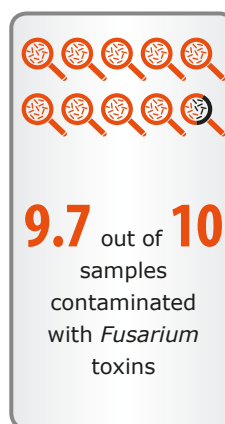
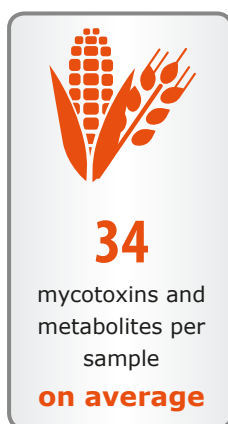
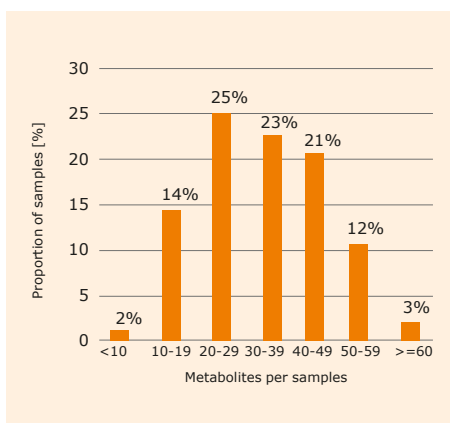
*Cereals: wheat, barley, oats, sorghum.

Multiple Mycotoxin Overview



Multiple mycotoxin occurrence

Spectrum 380® results 2018: the most comprehensive mycotoxin analysis available*



691 samples

In which raw materials are emerging mycotoxins most commonly found?



Wheat:

Aurofusarin 96%
Moniliformin 92%
Enniatin 92%



Maize:

Moniliformin 97%
Culmorin 87%
Beauvericin 81%



Finished Feed:

Moniliformin 96%
Culmorin 92%
Beauvericin 84%

Mycotoxins & metabolites

	Average	Maximum	Rank	
Moniliformin	88%	110	1696	1
Aurofusarin	85%	682	25872	2
cyclo(L-Pro-L-Tyr)	84%	542	13936	3
Tryptophol	83%	235	7367	4
Culmorin	81%	648	19792	5
cyclo(L-Pro-L-Val)	78%	1232	19827	6
Deoxynivalenol	75%	753	22984	7
Enniatin B1	72%	68	1846	8
Zearalenone	71%	30	795	9
Equisetin	71%	59	6120	10
15-Hydroxyculmorin	70%	638	22584	11
Beauvericin	69%	20	343	12
Enniatin B	68%	65	987	13
Brevianamid F	65%	115	1524	14
Emodin	62%	44	4187	15
Asperglaucide	61%	85	6169	16
Infectedopyron	59%	1621	181067	17
Tenuazonic acid	59%	295	15933	18
Rugulosovin	59%	65	1198	19
Altersetin	58%	115	6018	20
Enniatin A1	58%	24	549	21
Asperphenamate	57%	104	14703	22
Bikaverin	57%	27	619	23
Flavoglucan	56%	431	43390	24
Questiomycin A	54%	18	156	25
Neoechinulin A	54%	165	10870	26
Fumonisin B1	52%	846	30307	27
3-Nitropropionic acid	51%	21	791	28

Positive Samples [%] for metabolites present in more than 50% of samples
(orange bars indicate regulated or guideline mycotoxins)
Cut off for all metabolites 1 ppb (except for aflatoxins 0.5 ppb)

*Spectrum 380® is developed and conducted by the world's leading independent mycotoxin research lab at the Department of Agrobiotechnology (IFA-Tulln) at the University of Natural Resources and Life Sciences Vienna and offered through cooperation with BIOMIN.



Mycofix®

Absolute Protection

Powered by science to actively defend against multiple mycotoxins*

With 3 combined strategies



ADSORPTION



BIOTRANSFORMATION



BIOPROTECTION



*Authorized by EU Regulations No 1115/2014, 1060/2013, 1016/2013, 2017/913, 2017/930 and 2018/1568 for the reduction of contamination with fumonisins, aflatoxins and trichothecenes.

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