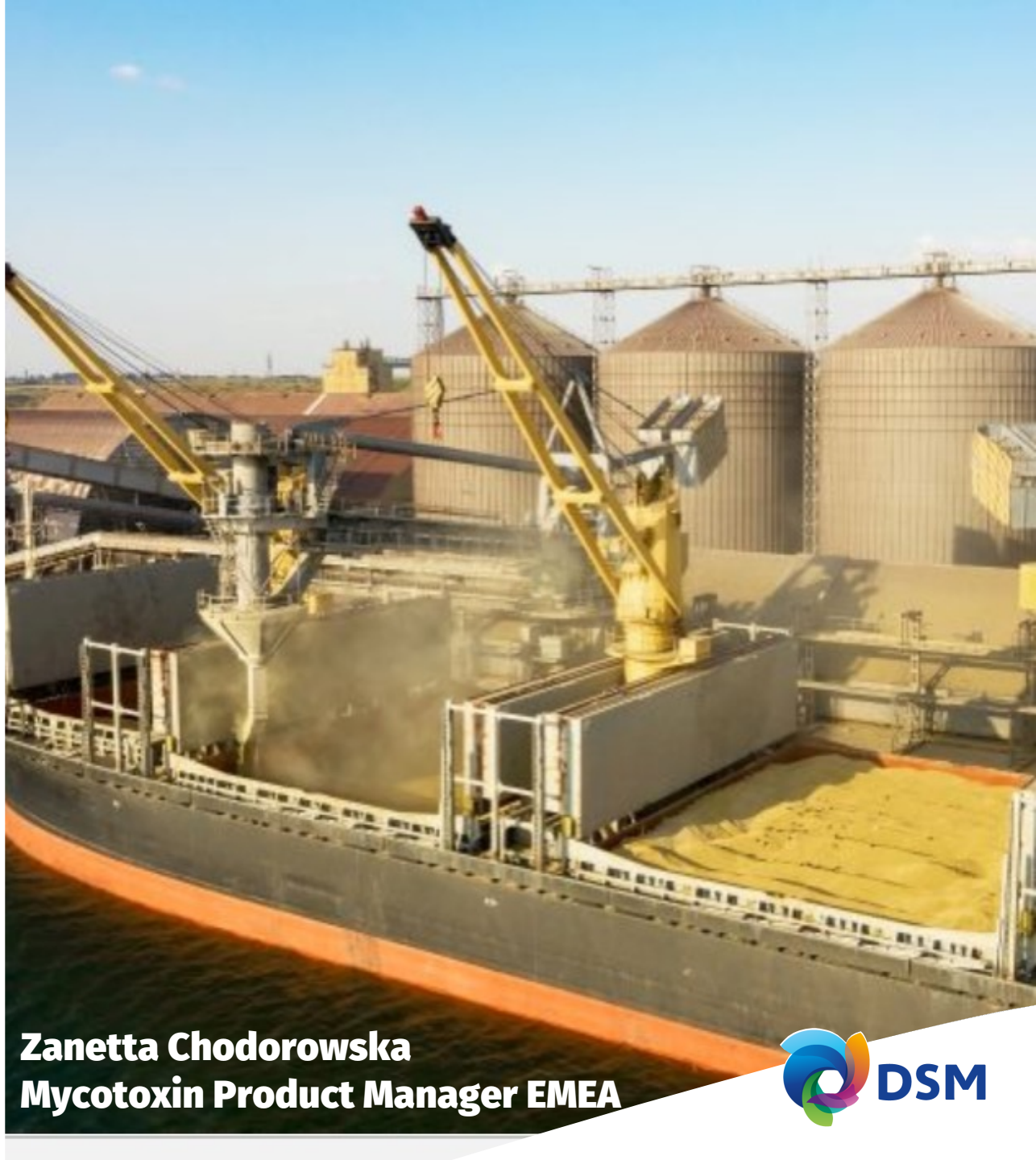
How to minimize mycotoxin risk if grain prices skyrocketed

- Disrupt global grain trade for at least two growing seasons,
- Grain prices will remain elevated,
- Commodity supply-demand imbalances,
- Fertilizer, crop chemical shortages .
- Significant tightening in available stocks-to-use ratios for both grains wheat and corn.



Zanetta Chodorowska
Mycotoxin Product Manager EMEA

DSM

30% less wheat planted this spring means a smaller harvest this summer and fall

Every grain matters, more than ever

- Before invasion, Ukraine was responsible for :
  12% of global wheat exports,
  16% of global corn exports, and
  46% of global sunflower oil production
  TIME BY ARYN BAKER APRIL 29, 2022 2:05 PM EDT

  Ukraine and Russia together account for around 30% of global wheat exports
- On 2 of May 4.7 mln ha planted in Ukraine
- Delays in US planting
- Weak winter crops rate in US

Source: National Geographic

Prices for major fertilizers skyrocket

Reduced use of fertilizer diminish the yield and quality of new crops .

- **Some fertilizers have more than doubled in price**
  - potash traded in Vancouver was priced at about $210 /MT beginning of 2021, and it's now valued at $565
  - urea for delivery to the Middle East was trading at $268/MT the Chicago Board of Trade in early 2021 and was valued at $887.50 (on 5 April 2022).
- **Farmers chose to reduce fertilizer or rotate crops will get lower yield (charged more – if they can for the crops)**

Rising temperatures, drought, flooding, fire in once-reliable agricultural areas

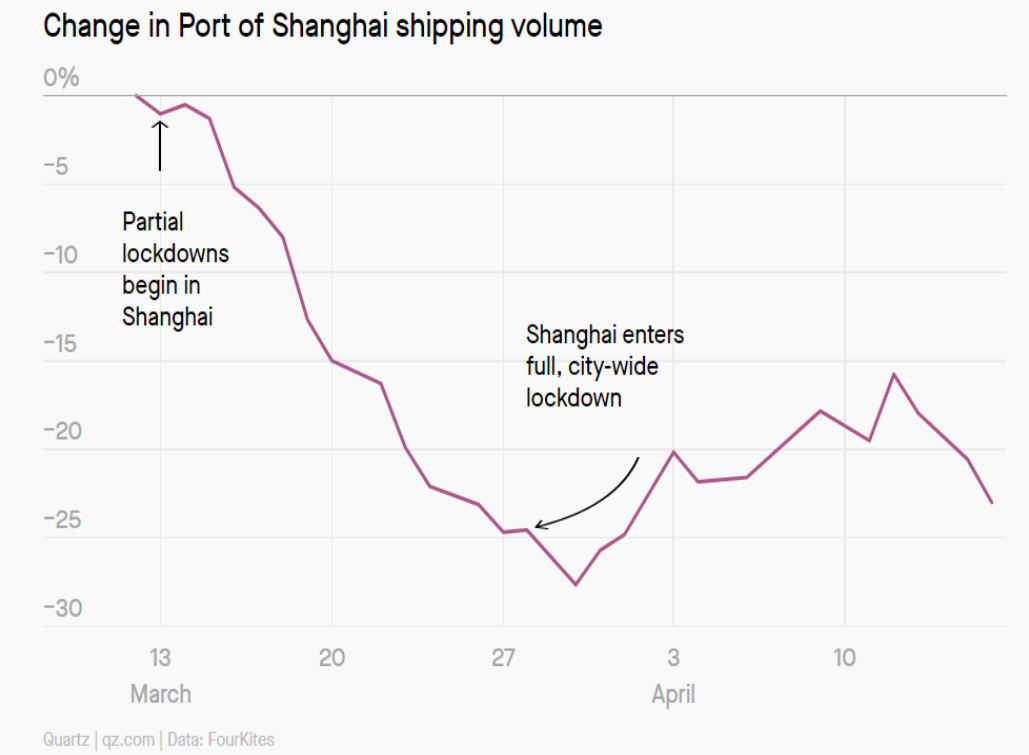
We need to account global wormings.

- **A record-setting heat wave in India**
  - April 2022 has reduced this year's wheat crop,
- **Flooding in Chin**a,
  - February 2022 wheat growing regions were hit by flooding.
- **Tornado in Germany!**
  - 20 May 2022
- **We need more**
  - Locally adapted breeds and hybrids that can tolerate more heat, or more pest resistant more climate change-resilient seeds and farming methods

"We are living in a one-degree warmer world, seeing more pests, more droughts, more heat.
(the Bill & Melinda Gates Foundation's)

Lockdown in major cities of Asia
As a result, shipping lines plan to cancel 1/3 of their scheduled routes out of Asia the next six weeks

Supply chain disruptions may return



By **Nicolás Rivero**
Tech Reporter

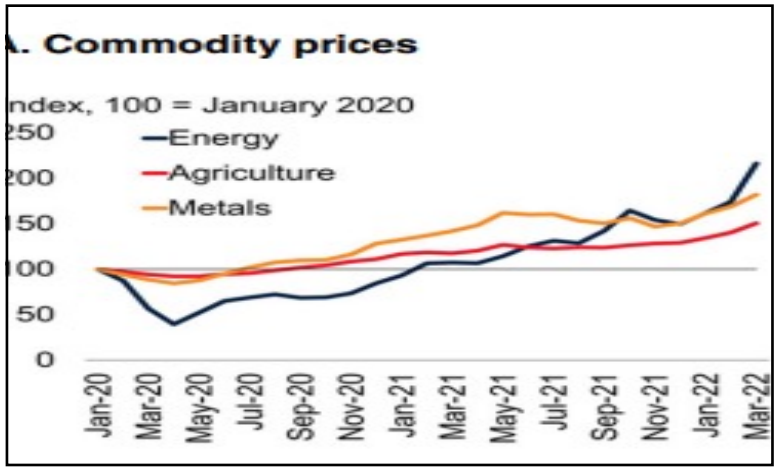
Published May 10, 2022

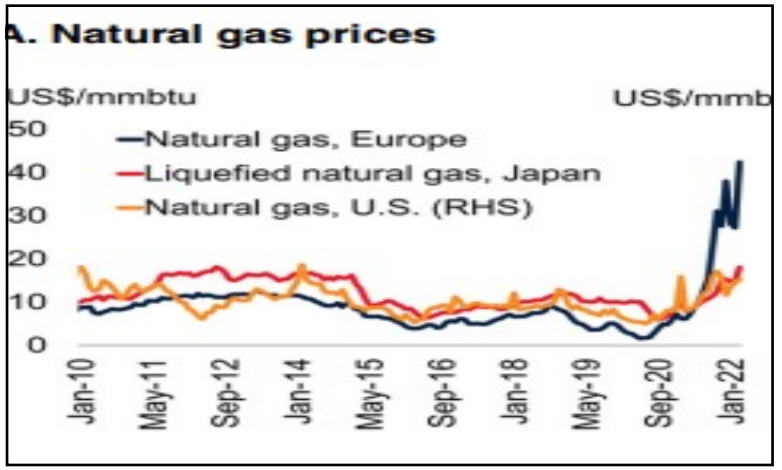
About 373 million people in 45 cities were living under some form of lockdown in China last month, according to an estimate from the Japanese financial services conglomerate Nomura Holdings. That's more than three-quarters of the entire EU population (448 million)

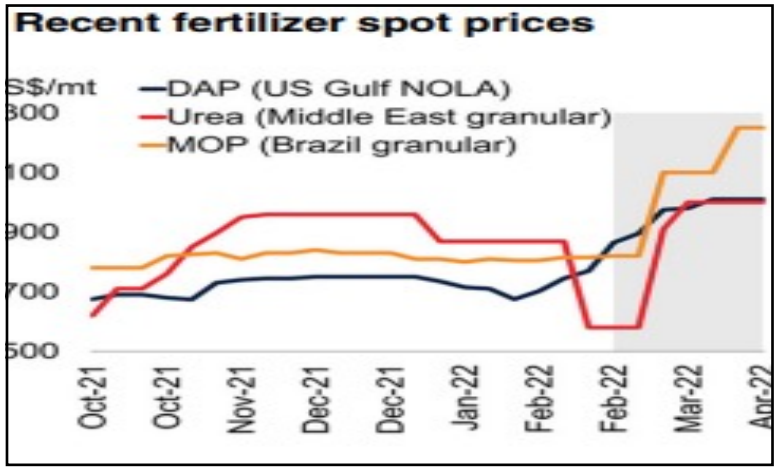
Recent market trends

Commodity price developments

Russia and Ukraine are large exporters, particularly energy, and some grains





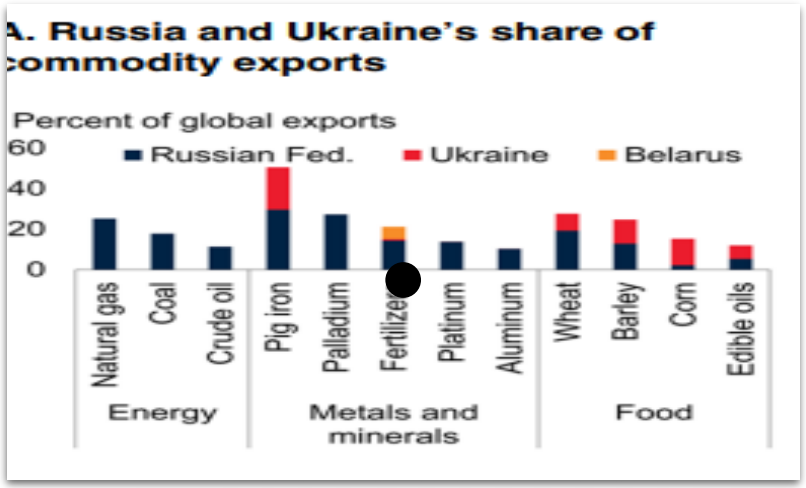


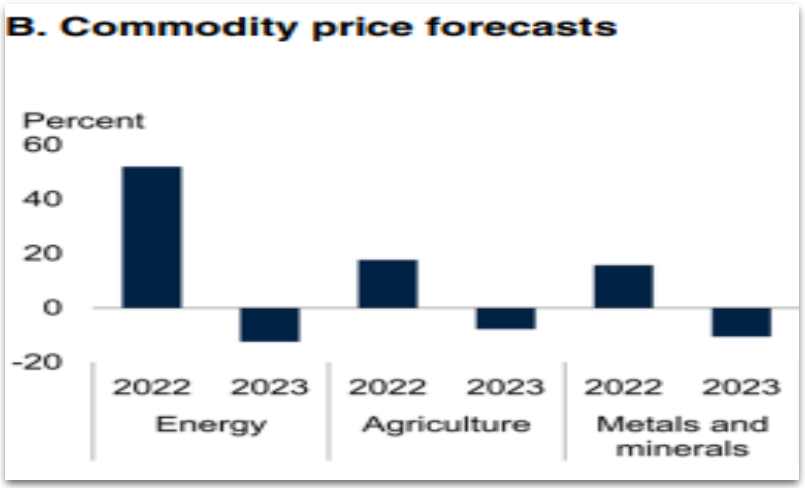
DAP = diammonium phosphate;
MOP = muriate of potash

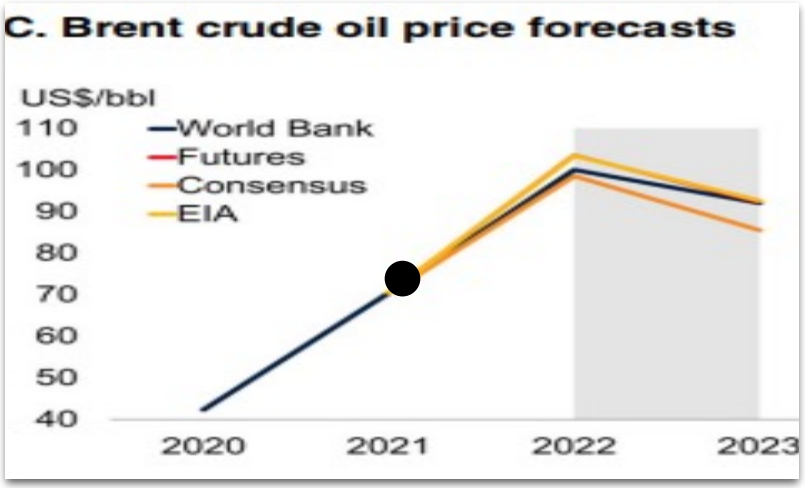
Source: World Bank. Note: All prices in U.S. dollar terms. A. Monthly data. Last observation is March 2022

Commodity markets forecast

Most commodity prices will rise significantly in 2022 and remain high







Sources: Bloomberg; BP Statistical Review; Energy Information Administration; International Energy Agency; UN Comtrade; U.S. Department of Agriculture; World Bank. A. Data for energy and food are trade volumes while metals and minerals are trade values. Fertilizers are phosphate rock and potash minerals, and ammonia-based non-minerals. Data are for 2020.

Results : Shortages

we need to make every grain count

Fertilizers shortage	Commodity shortage	Diesel & Gas Price	Global warming
reduce fertilizer rotate crops	Export reduction, sanctions	Export reduction sanctions	drought, flooding heat waves

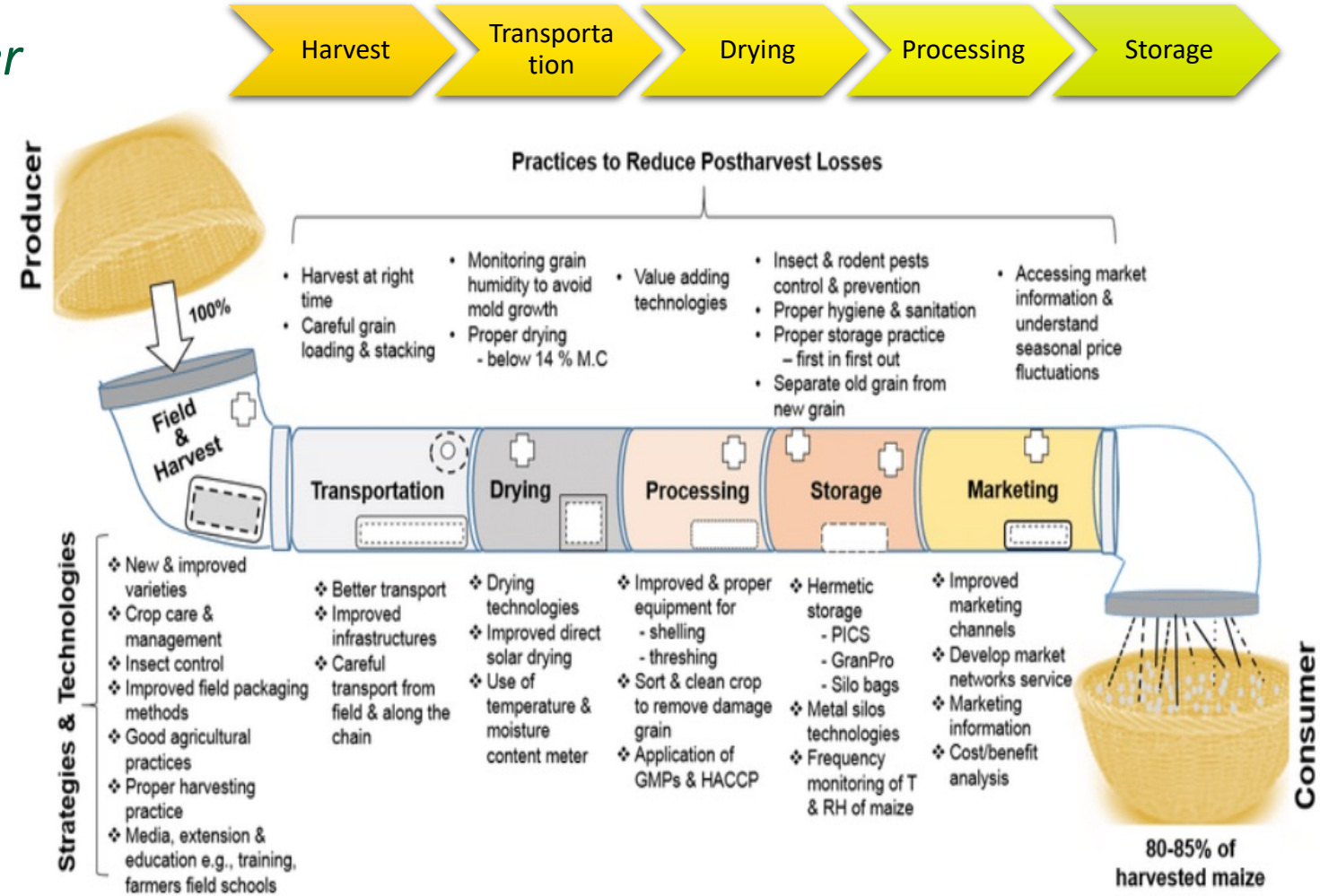
AFS, Reduction of Antibiotics and zinc oxide , Covid Pandemic ,Inflation…

We need to take an action

1.Reduce leakage Producer - Consumer

The United Nations (FAO),
the world cereal production in 2017/2018

- 42.4% human consumption
- 35.7% animal feed
- 21.8% other users
- 10-15% is lost each year post-harvest due to pest and fungal spoilage.



Adapted from Research gate R. Suleiman

propane has doubled in price from last year used to heat farmers' homes and power dryers to reduce corn moisture and make the grain suitable for storage and sale. 22/05/22

We need to take an action

2. Precise feeding / efficiency to decreasing feed costs

Precision feeding:

1. Adapt the diet's nutrient content to the animals' age and production phase
   - Right feed, right time, right place
2. Determine variations in raw material
   - Determine nutrients content and adjust feed formulation
3. Determine toxins and anti-nutrients in raw material
   - Finish feed LC MS/MS- MTX
   - Raw materials ELISA, LC MS/MS
4. Consider sourcing local raw materials,

Feed additive solutions:

1. FCR improvement
   - *Enzymes improve nutrient availability*
   - *Phytomolecules*
2. Feed quality improvement
   - *Mitigating the negative impact of mycotoxins*
3. Use of feed alternatives
   - *Mitigating the negative impact of mycotoxins*

We need to take an action,

3. Control feed safety,

Tips to Control Feed Safety

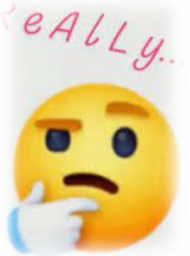
1. **Only employee access**
2. **Air filtration and dust control**
3. **Pest control**
4. **Quality of supply and storage ingredients**
5. **Monitor potential microbial hazards**
6. **Fencing, locks and access control**
7. **Lights and cameras**
8. **Use- sign in books religiously**
9. **Talk with local low enforcement**
10. **Truck sanitation**

We need to take an action,

4. Feed replacement - consequence higher diversity in the ingredients.

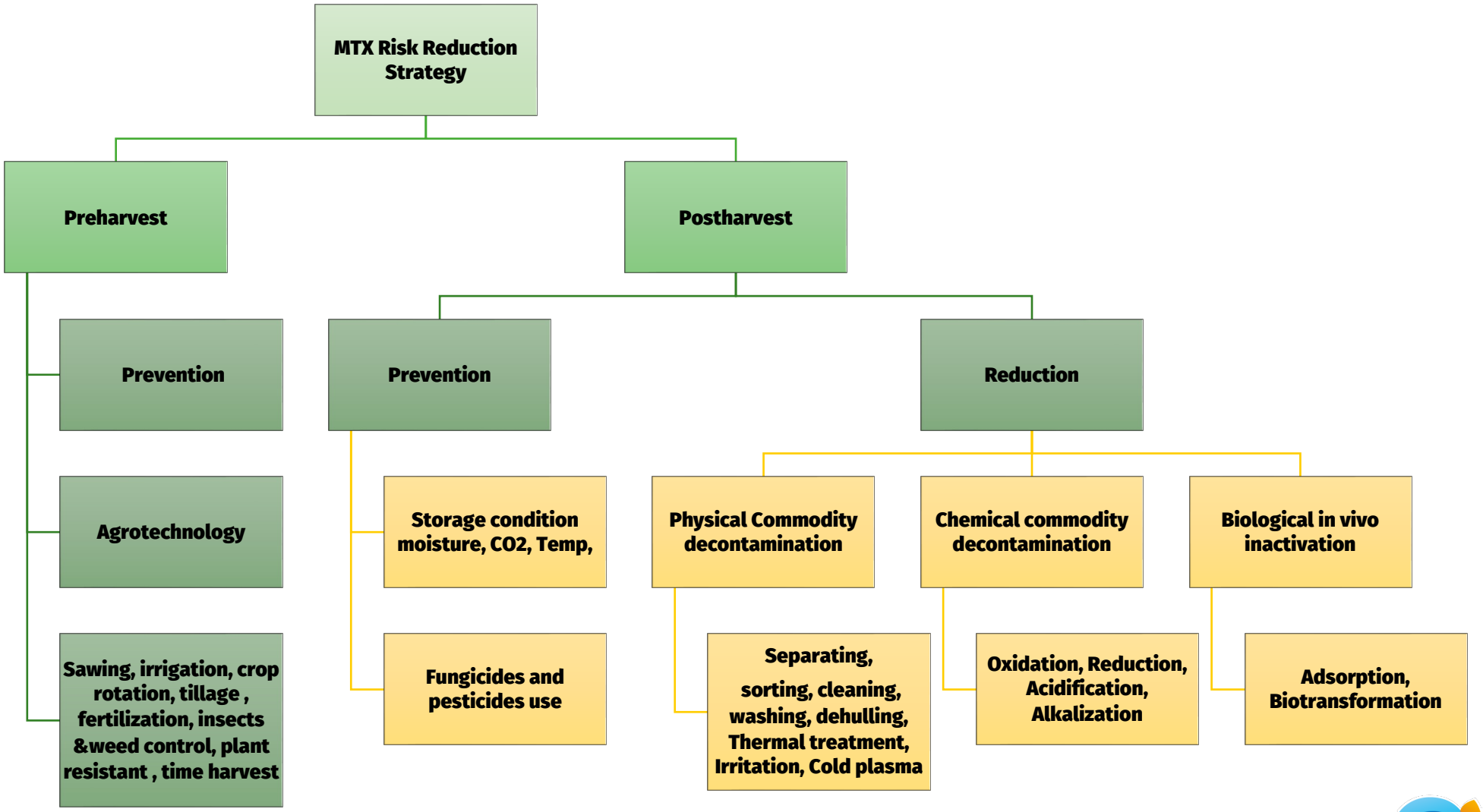
1. Standard raw material replacement with:
    1. Lower quality raw material
    2. By- products
    3. Supplements
2. Unequal material in
    1. nutrients content &bioavailability
    2. contamination
3. Quality monitor
    1. Nutrient content
    2. Mycotoxin contamination
    3. Microbial load

Booking contracts earlier with more reliable suppliers and paying a premium.



We need to take an action

*5.**MTX losses, focus on prevention***



Hahn, Berthiller 2015

We need to take an action

Actions for Mycotoxin Management in Wheat, Corn, Barley and Other Small Grains

Monitor contamination

1. Contamination cannot be visually detected
2. Good-looking raw materials can have a high contamination
3. Analysis can confirm the presence of mycotoxins.
    1. Collect a representative sample
    2. Use the proper sampling method
    3. Contact DSM

MTX are stable and resistant

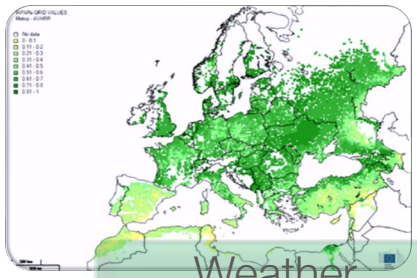
- Temperature up to 250°C (such as extrusion, pelletizing, flacking etc.),
- Physical and chemical treatments (such as cleaning and ammoniac),
- Fermentation,
- Molds inhibitor during storage (such as organic acids which destroy only fungus and not the mycotoxins) and
- Time (even long storage periods).

Biomin® mycotoxin prediction

We need to take an action

Mycotoxin prediction

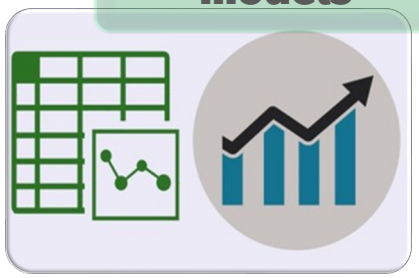
How prediction models work



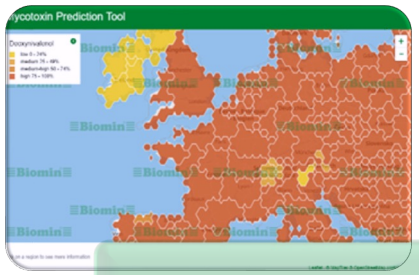
Weather Data Input

Crop management

Cloud database



Forecasting models

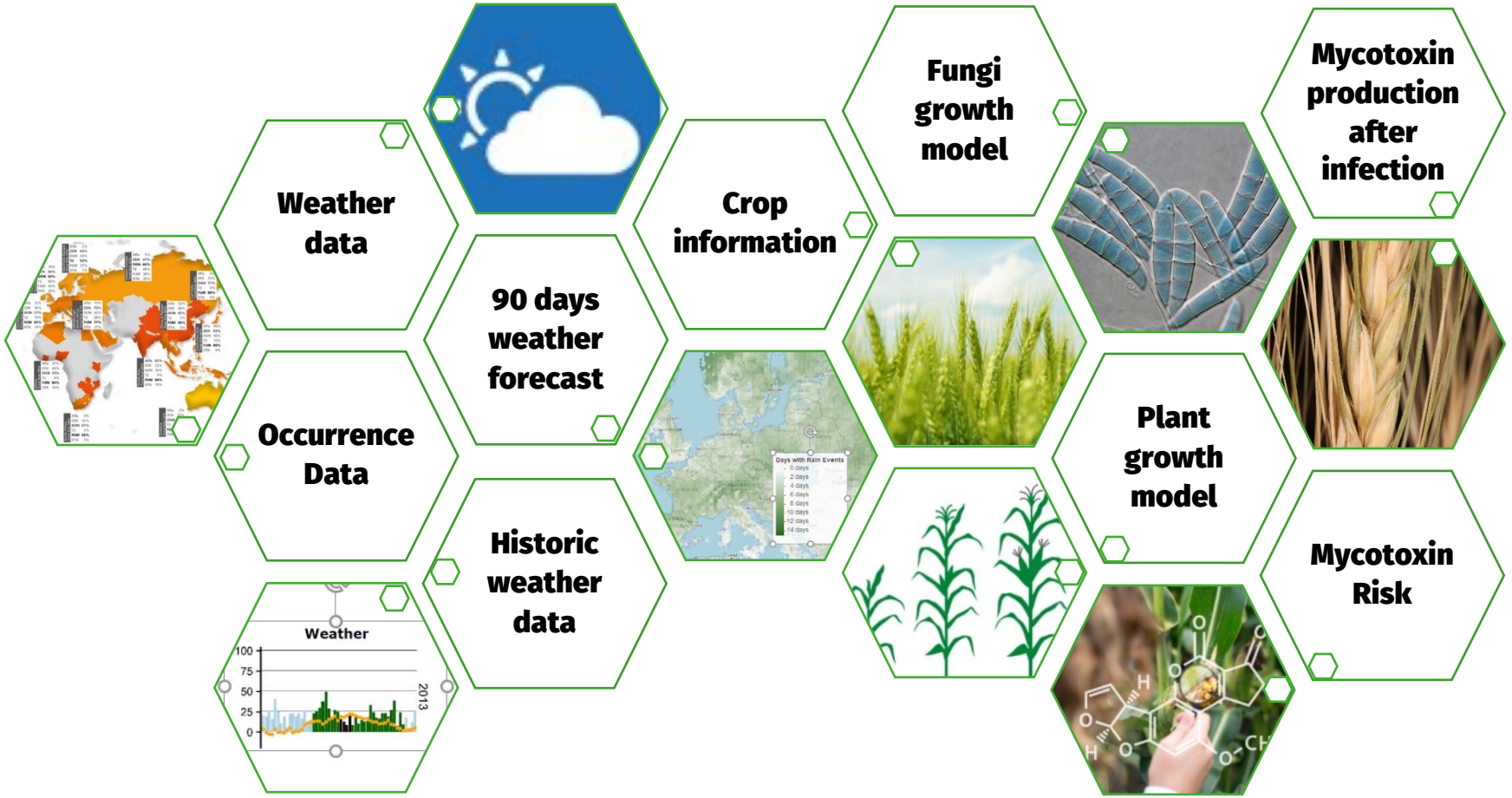


Mycotoxin Risk

DSM

MTX prediction tool

What are predictions based on :

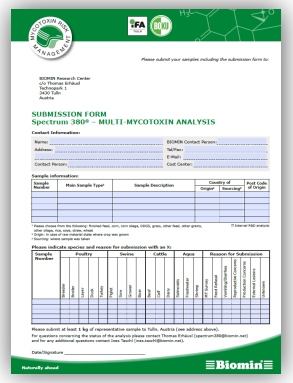


Monitoring contamination

Final feed control - Spectrum Top 50®, Spectrum 380®

Sample collected by/sent to DSM/Romer representative

Sample sent to DSM/BIOMIN QC in Tulln with order form→ Email to contact person that sample arrived

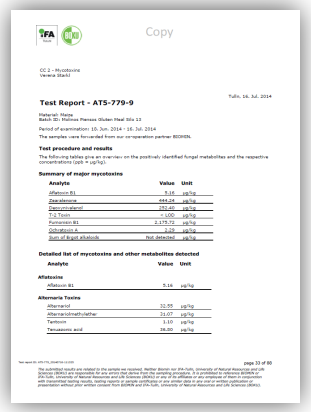


SUBMISSION FORM
Spectrum 380® – MULTI-MYCOTOXIN ANALYSIS

Sample sent to IFA Tulln once/week

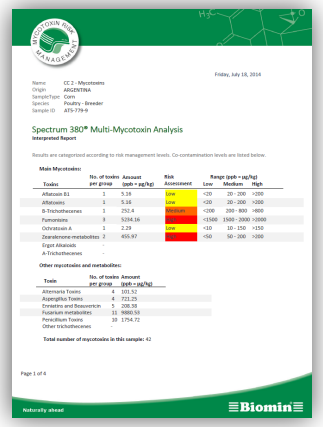
LC-MS/MS analysis & data evaluation:

5 or 10 working days depends frot the type of analysis



Test Report - ATS-779-9

Reports are sent to DSM/Romer representative

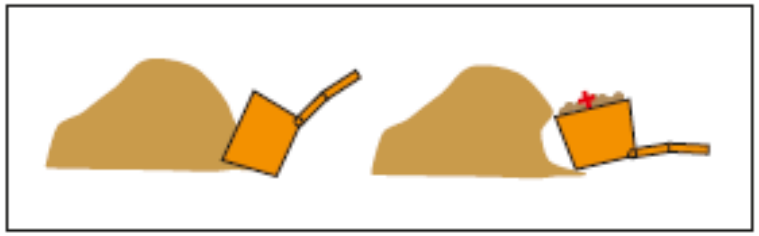


Spectrum 380® Multi-Mycotoxin Analysis

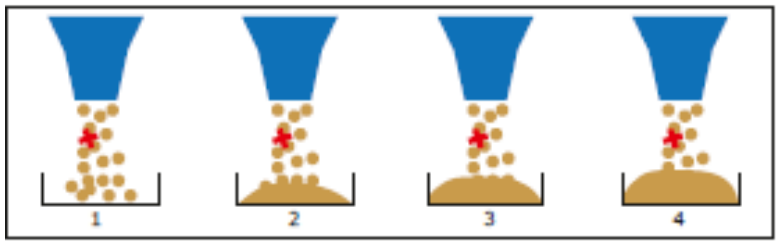
Monitoring

Sampling during transfer (i.e. loading bucket, loading spout)

Sampling from a **moving stream:** The **red x** represents the place where the incremental sample should be collected.



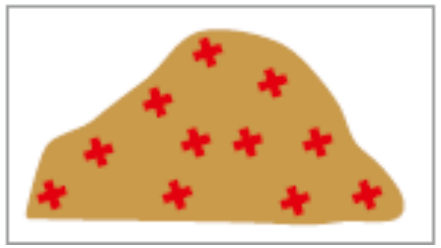
Sampling of grains **during transfer with loading bucket**. The **red x** represents the place where the sample should be collected.



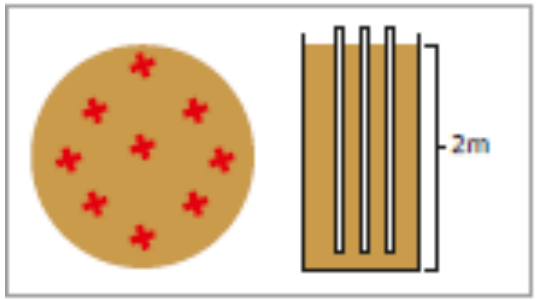
Sampling of grains from the **moving stream of a loading spout**. The **red x** represents the place where the sample should be collected.

Monitoring

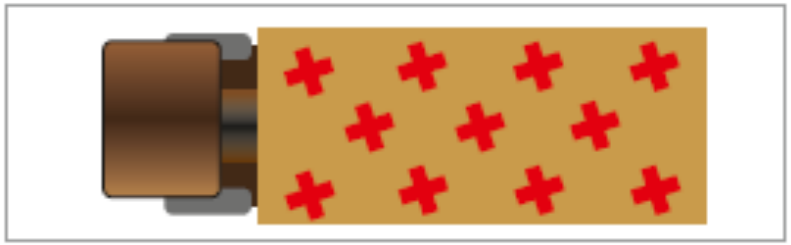
Sampling in place of storage



Sampling of **grain heaps**. The **red x** represents the place where the sample should be collected.



Sampling of grains in a **tower silo**. The **red x** represents the place where the sample should be collected.



Sampling of grains in a **truck**. The **red x** represents the
place where the sample should be collected.

Monitoring

Mycotoxin Analytical Methods

ELISA

Quantification of specific mycotoxins in given matrices

- Fast
- Inexpensive
- Raw materials only

HPLC

Quantification of single toxins at low concentrations

- Fullfils legal requirements
- More time consuming
- More expensive

LC-MS/MS:

Spectrum 380® and Spectrum Top 50

Simultaneous detection of multiple toxins in a wide variety of commodities

- **Sensitive method**
- **Suitable for various feed matrices**
- **Detection of masked & emerging mycotoxins**
- Highly qualified operator needed
- More expensive

The latest innovation in Mycotoxin Rapid Testing

AgraStrip® Pro WATEX®

Application: field, storage, raw material reception

- Lateral Flow Devices for AFLA, DON, ZON, FUM, OTA
- **Rapid, on-site detection of mycotoxins in a variety of agricultural commodities.**
- **Reliable, quantitative results in 11 minutes; 4 samples in parallel, 4 min. assay time;**
- **Simple procedure and intuitive, walk-away operation. No sophisticated training needed.**
- **Extensive Global Technical Support**

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

19/04/2022

RU22-04-58

Name
Origin Russia
SampleType Corn - Corn
Species КРС -,
Sample ID RU22-04-58
Description -

Мульти-анализ на микотоксины Spectrum®

Интерпретация результатов анализа

Результаты упорядочиваются в соответствии со степенью риска. При повышенной влажности образца перед проведением анализа его высушивают, но результаты интерпретируют исходя из его первоначального веса. Уровни совместной контаминации указаны ниже. Обратите внимание на то, что, при анализе сырья, для подсчета общего уровня риска в готовом корме необходимо учитывать процент содержания в нем каждого из проанализированных ингредиентов.

Пустые области в таблице означают отсутствие микотоксинов в образце.

Основные микотоксины:

Токсины	токсинов на группу	Количество (ppb = µg/kg)	Уровень риска	Пределы (ppb = µg/kg) Низкий	Средний	Высокий
B-Трихотецены	3	1014,75	Высокий	<500	500 - 1000	>1000
A-Трихотецены	3	206,54	Средний	<100	100 - 400	>400
Зеараленон	3	6125,48	Высокий	<100	100 - 200	>200
Фумонизины	3	20126,38	Высокий	<2000	2000 - 4000	>4000

Другие микотоксины и метаболиты:

Токсины	Количество (ppb = µg/kg)
Альтернариол	38,21
Альтернариола-метиловый	6,93
Бовericин	403,03
Монилиформин	676,01
Микофеноловая кислота	453,98
Тенуазоновая кислота	35,38

Общее число микотоксинов в образце: 16

Страница 1 из 4

ANIMAL NUTRITION AND HEALTH

08.12.2021

RU21-12-99 !

Name
Origin Russia
SampleType Corn-Corn
Species Птица - бройлеры
Sample ID RU21-12-99
Description -

Мульти-анализ на микотоксины Spectrum®

Интерпретация результатов анализа

Результаты упорядочиваются в соответствии со степенью риска. При повышенной влажности образца перед проведением анализа его высушивают, но результаты интерпретируют исходя из его первоначального веса. Уровни совместной контаминации указаны ниже. Обратите внимание на то, что, при анализе сырья, для подсчета общего уровня риска в готовом корме необходимо учитывать процент содержания в нем каждого из проанализированных ингредиентов.

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Токсины	токсинов на группу	Количество (ppb = µg/kg)	Уровень риска	Пределы (ppb = µg/kg) Низкий	Средний	Высокий
B-Трихотецены	3	866,42	Средний	<300	300 - 1000	>1000
Зеараленон	2	26,07	Низкий	<100	100 - 400	>400
Фумонизины	3	19460,36	Высокий	<2000	2000 - 3000	>3000

Другие микотоксины и метаболиты:

Токсины	Количество (ppb = µg/kg)
Альтернариол	4,01
Альтернариола-метиловый	3,05
Бовericин	645,88
Монилиформин	1107,18
Тенуазоновая кислота	208,53

Общее число микотоксинов в образце: 12

Страница 1 из 4

Naturally ahead

Biomin®

DSM

Mycotoxins are a permanent threat!
BIOMIN Mycotoxin Survey 2021

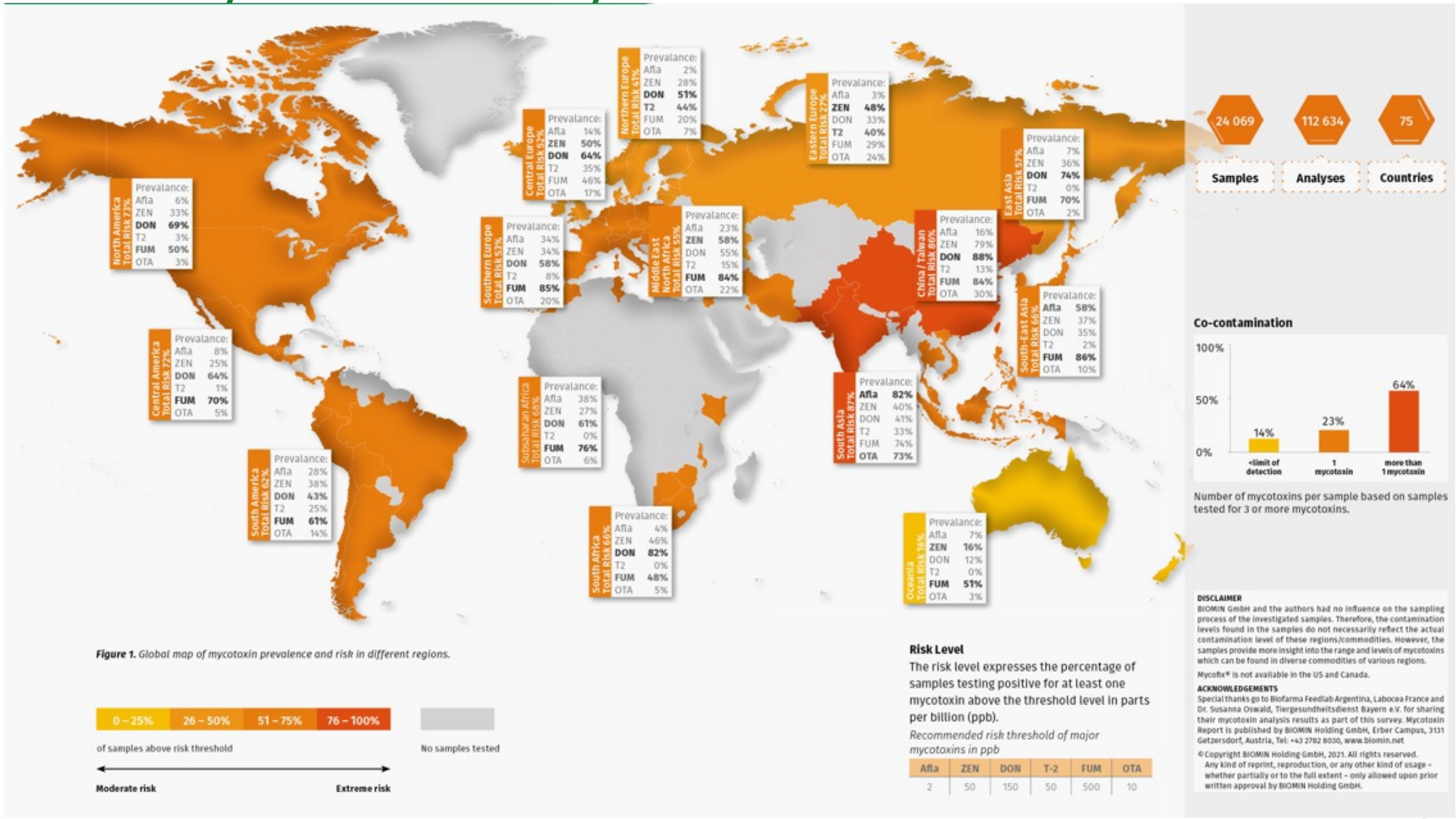

Figure 1. Global map of mycotoxin prevalence and risk in different regions.

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).

Recommended risk threshold of major mycotoxins in ppb

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

Co-contamination

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

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
Special thanks go to Biofarma Feedlab Argentina, Labocea France and Dr. Susanna Oswald, Tiergesundheitsdienst Bayern e.V. for sharing their mycotoxin analysis results as part of this survey. Mycotoxin Report is published by BIOMIN Holding GmbH, Erber Campus, 3131 Getzersdorf, Austria, Tel: +43 2782 8030, www.biomin.net

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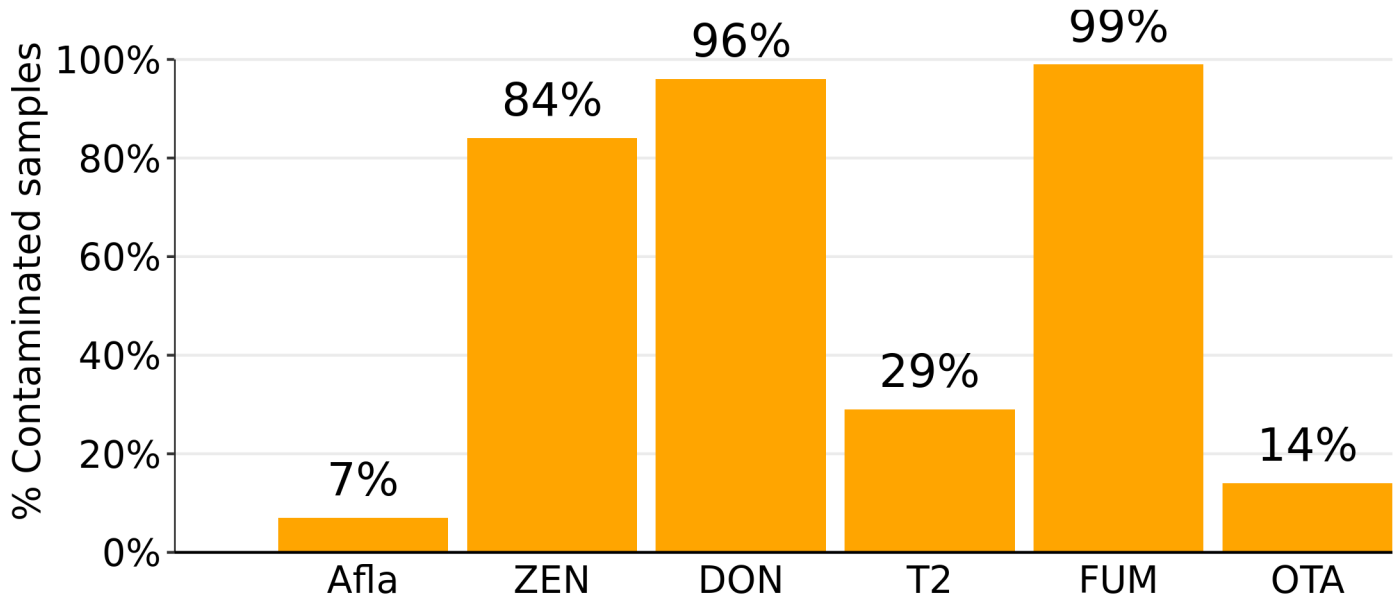
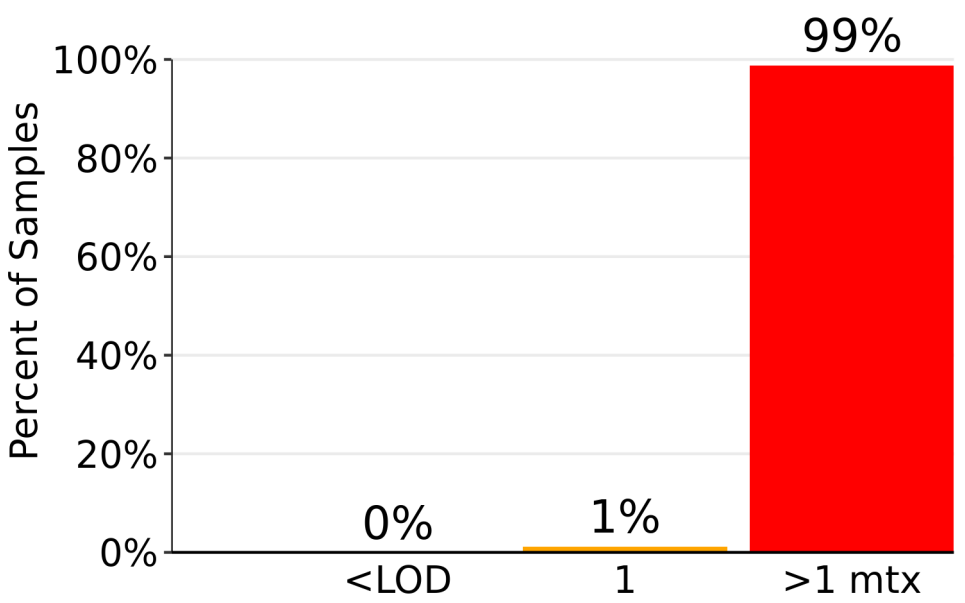
Summary for Finished Feed (all types) in HU from Jan 2021 to Dec 2022

Parameter	Afla	ZEN	DON	T2	FUM	OTA
Number of samples	85	85	85	85	85	85
% Contaminated samples	7%	84%	96%	29%	99%	14%
% Above risk threshold	1%	41%	58%	0%	4%	4%
Average of positives (ppb)	2	65	345	13	175	5
Median of positives (ppb)	1	48	213	13	130	1
Maximum (ppb)	7	308	1971	21	1230	27

Prevalence of Mycotoxins Detected



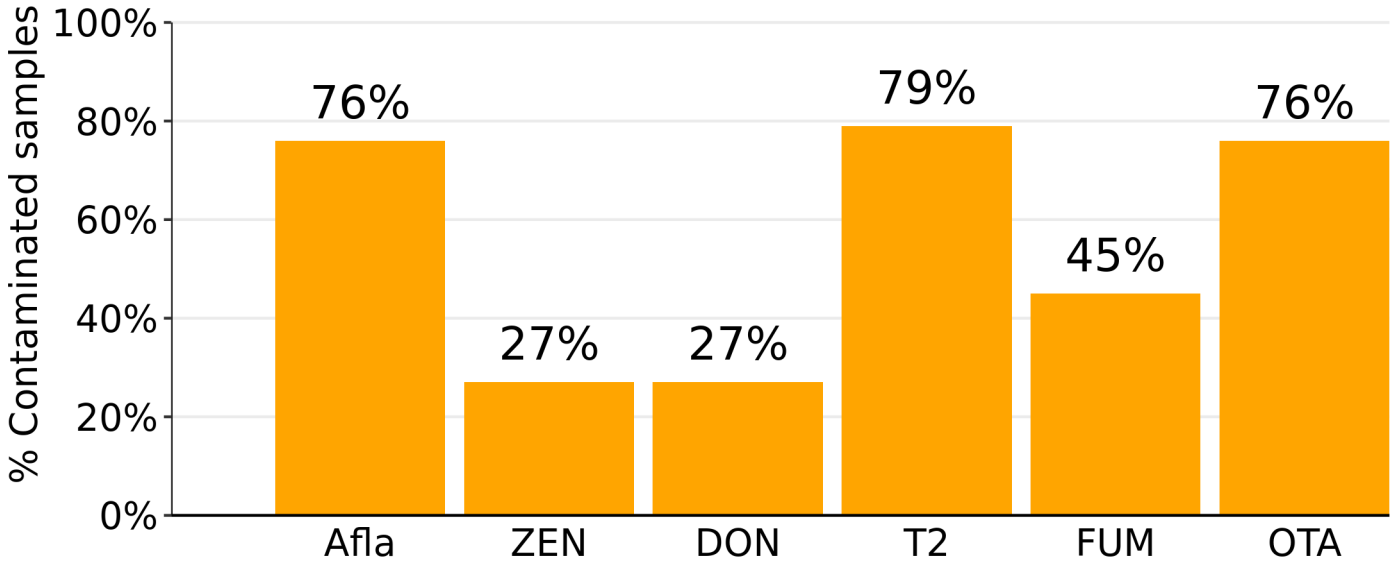
No. of Mycotoxins per Sample



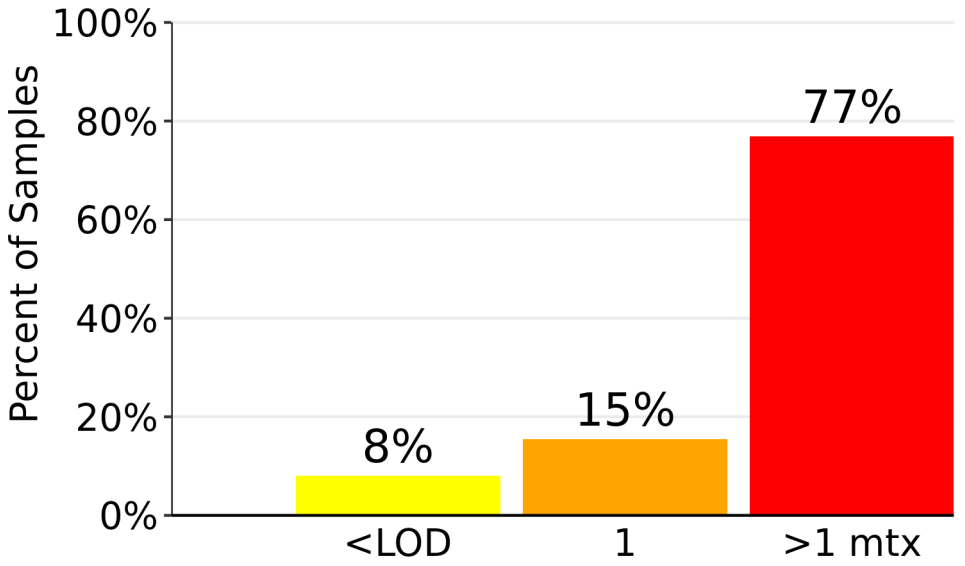
Summary for Wheat grain in HU from Jan 2021 to Dec 2022

Parameter	Afla	ZEN	DON	T2	FUM	OTA
Number of samples	34	33	33	33	33	33
% Contaminated samples	76%	27%	27%	79%	45%	76%
% Above risk threshold	74%	9%	24%	33%	15%	6%
Average of positives (ppb)	3	42	295	55	562	5
Median of positives (ppb)	3	28	252	47	374	4
Maximum (ppb)	4	80	721	125	2677	11

Prevalence of Mycotoxins Detected



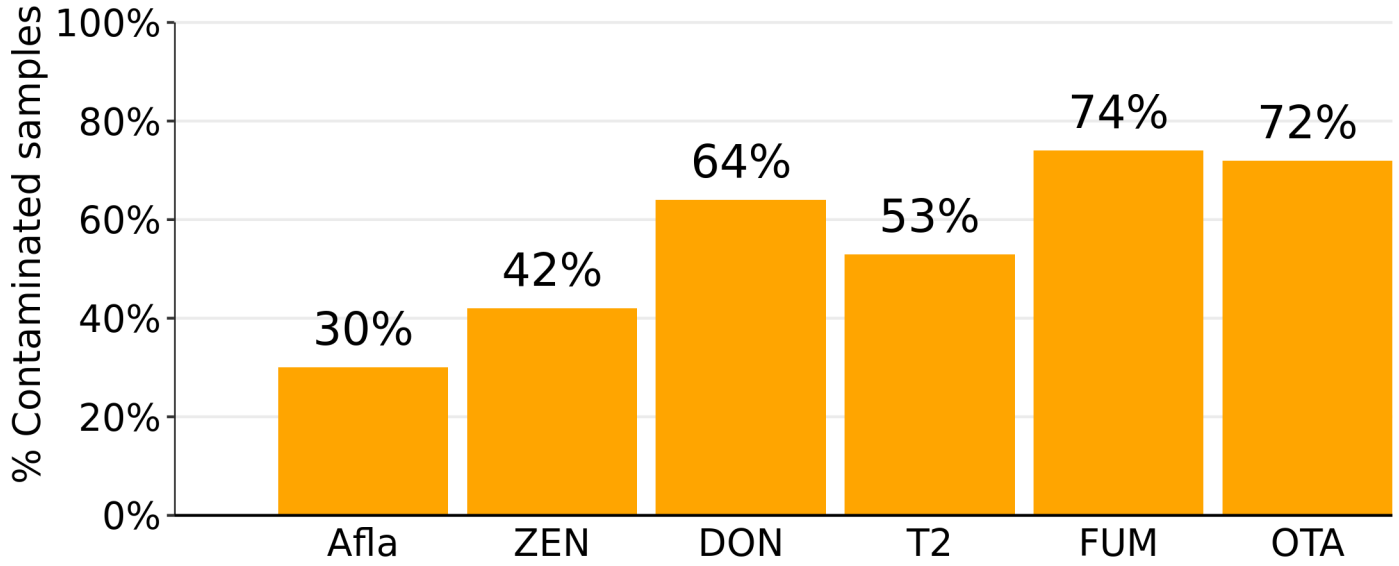
No. of Mycotoxins per Sample



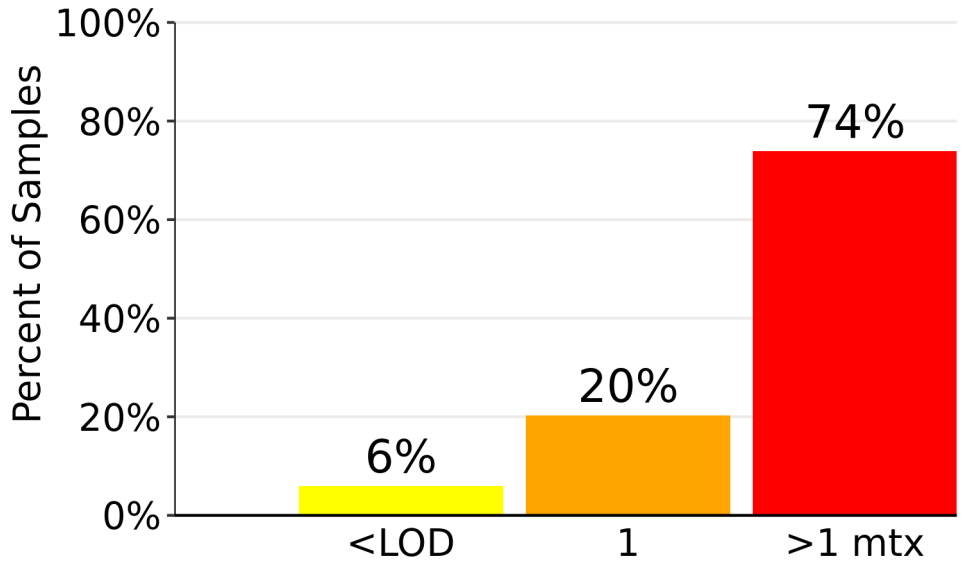
Summary for Corn (all types) in HU from Jan 2021 to Dec 2022

Parameter	Afla	ZEN	DON	T2	FUM	OTA
Number of samples	56	53	53	53	53	53
% Contaminated samples	30%	42%	64%	53%	74%	72%
% Above risk threshold	29%	17%	62%	9%	45%	8%
Average of positives (ppb)	11	120	571	27	1538	7
Median of positives (ppb)	4	39	448	16	754	4
Maximum (ppb)	44	806	3019	93	10586	51

Prevalence of Mycotoxins Detected



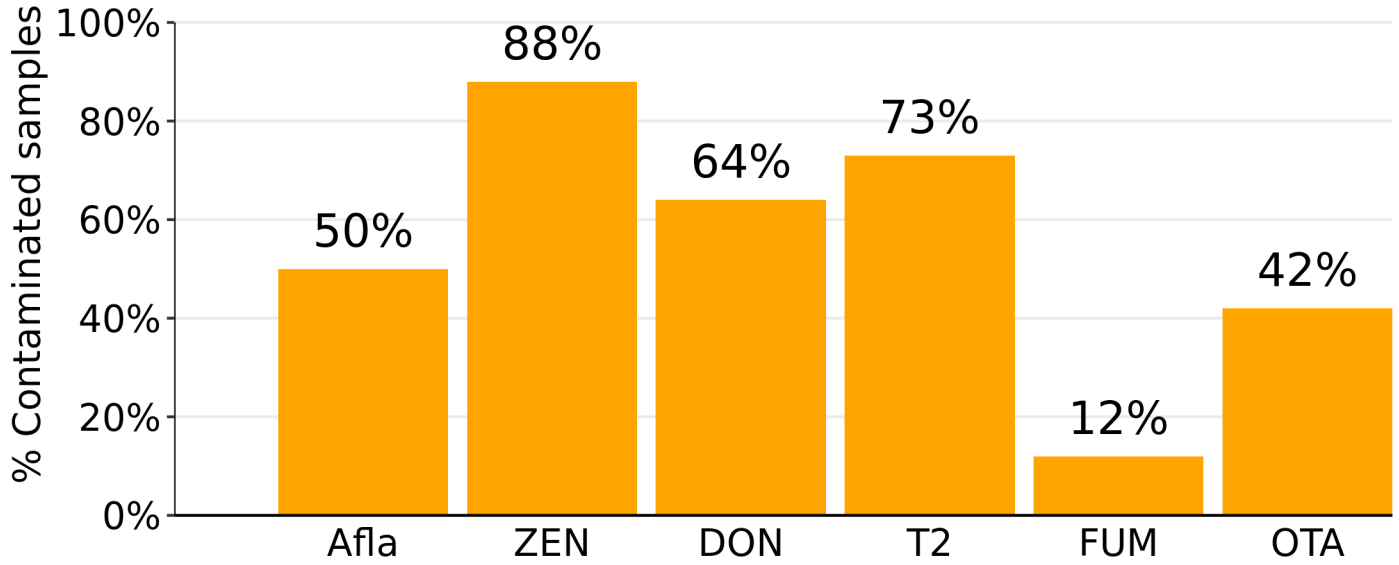
No. of Mycotoxins per Sample



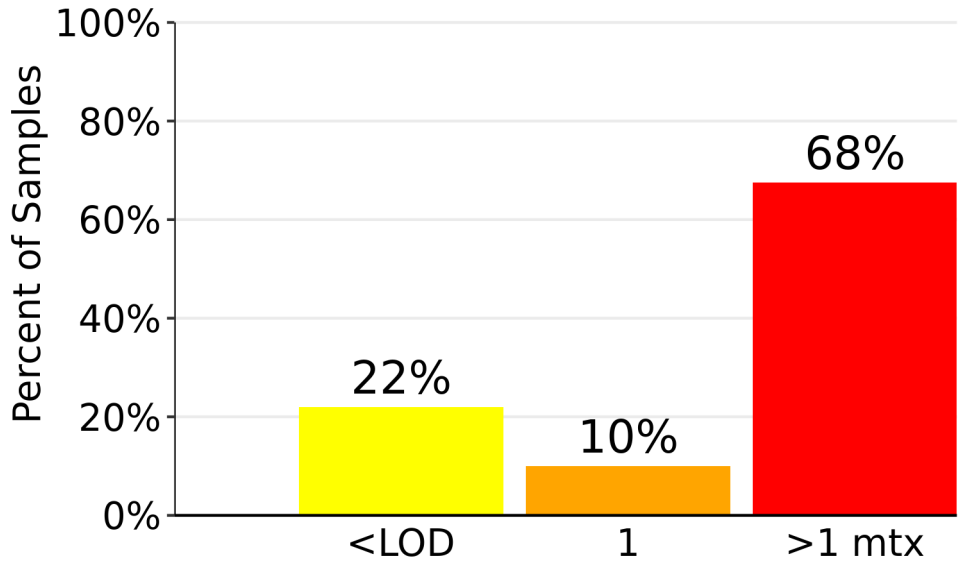
Summary for Soybean (all types) in HU from Jan 2021 to Dec 2022

Parameter	Afla	ZEN	DON	T2	FUM	OTA
Number of samples	36	33	33	33	33	33
% Contaminated samples	50%	88%	64%	73%	12%	42%
% Above risk threshold	50%	55%	61%	6%	0%	0%
Average of positives (ppb)	3	90	667	26	186	4
Median of positives (ppb)	2	53	705	22	177	3
Maximum (ppb)	7	606	865	84	367	6

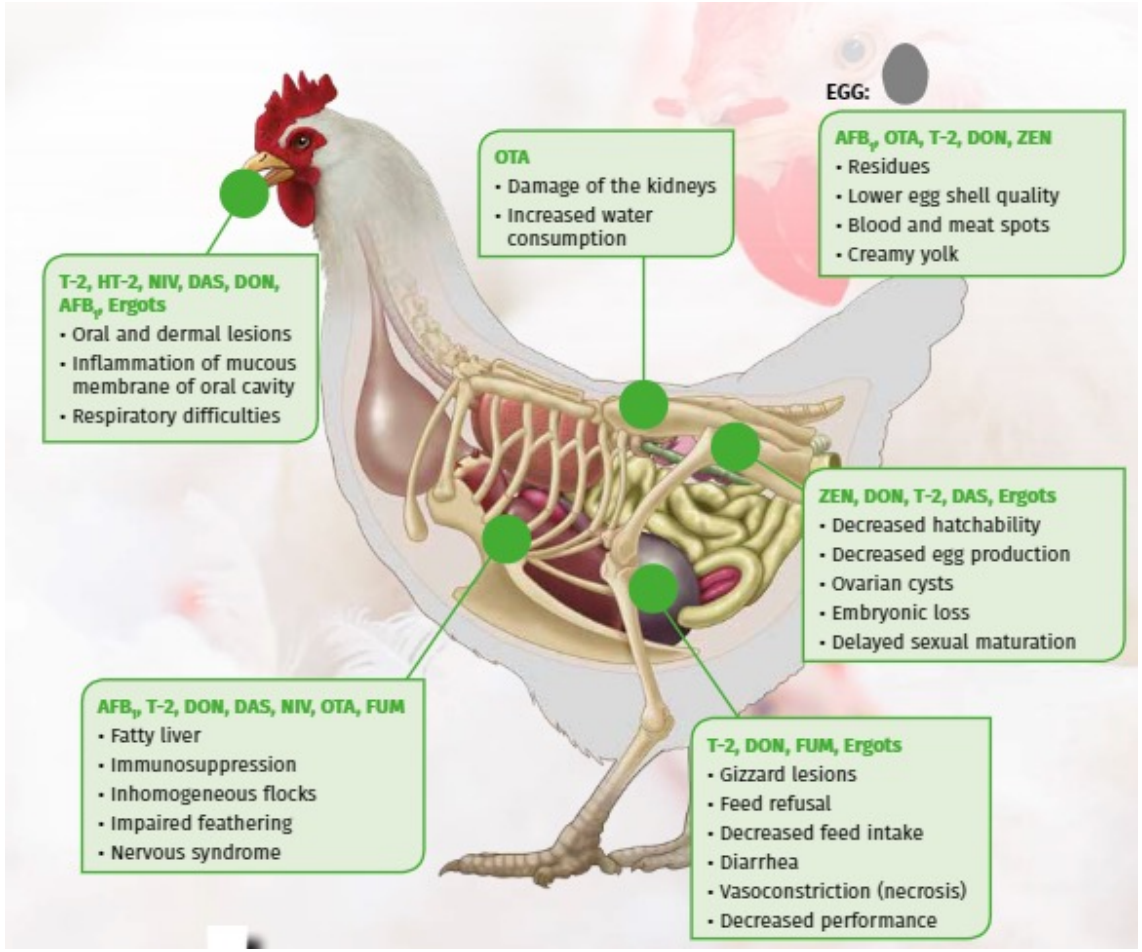
Prevalence of Mycotoxins Detected

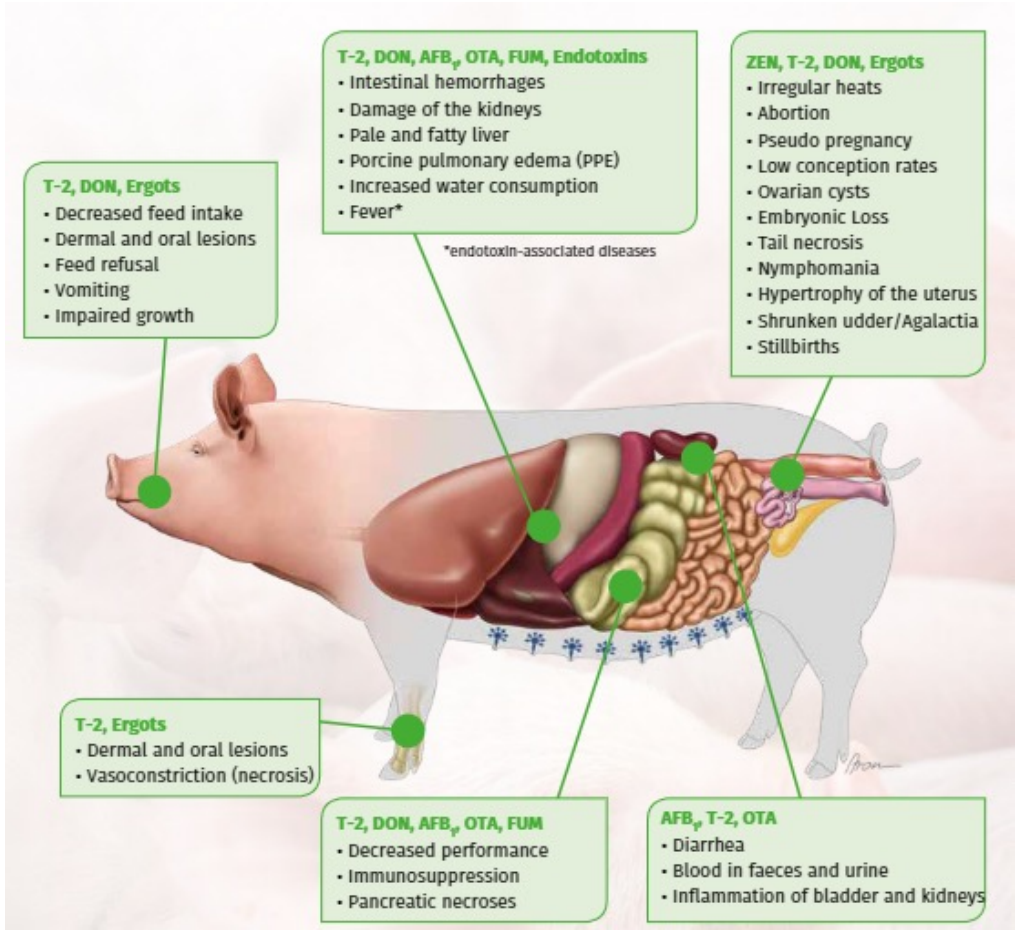


No. of Mycotoxins per Sample

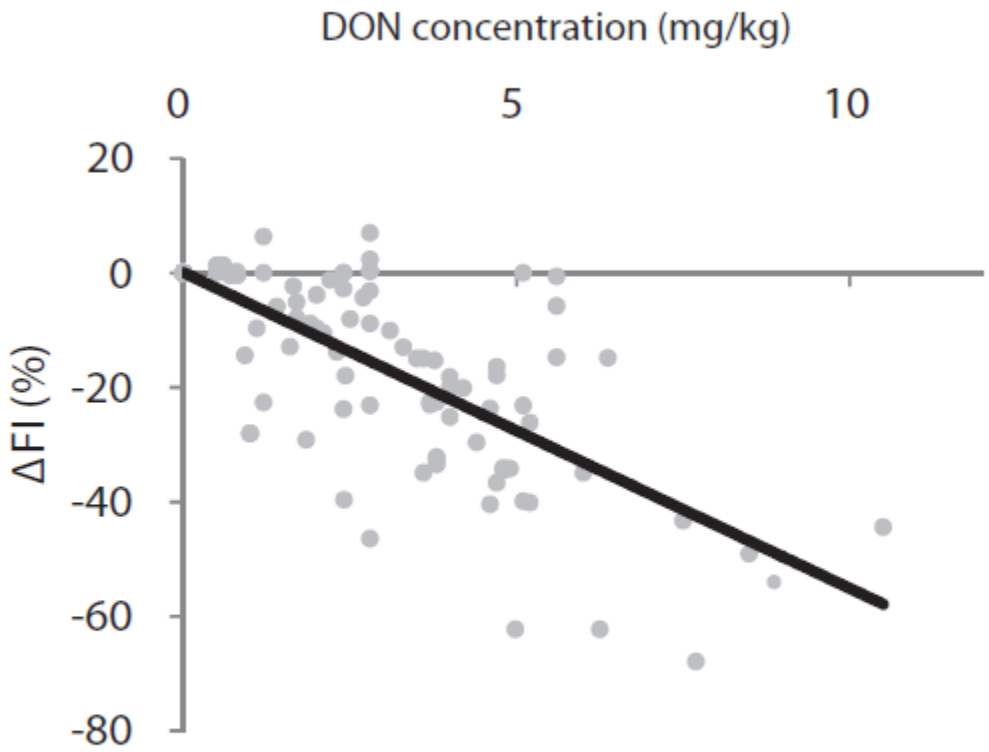


How mycotoxin effect animals





How mycotoxin effect animals
Effect on performance: Feed intake and Weight gain



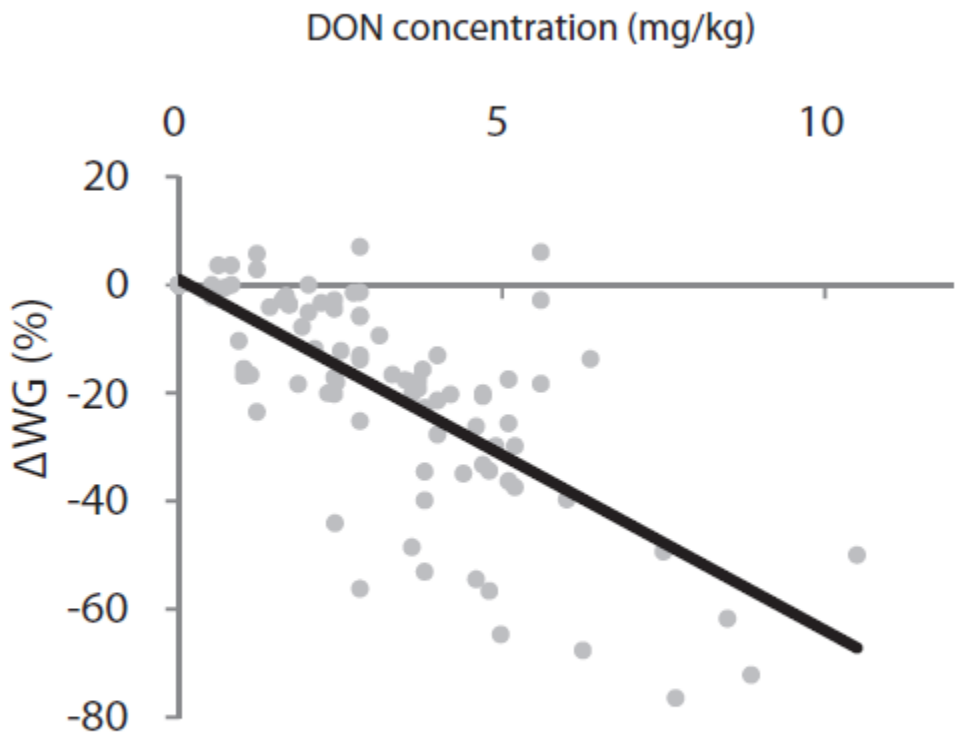
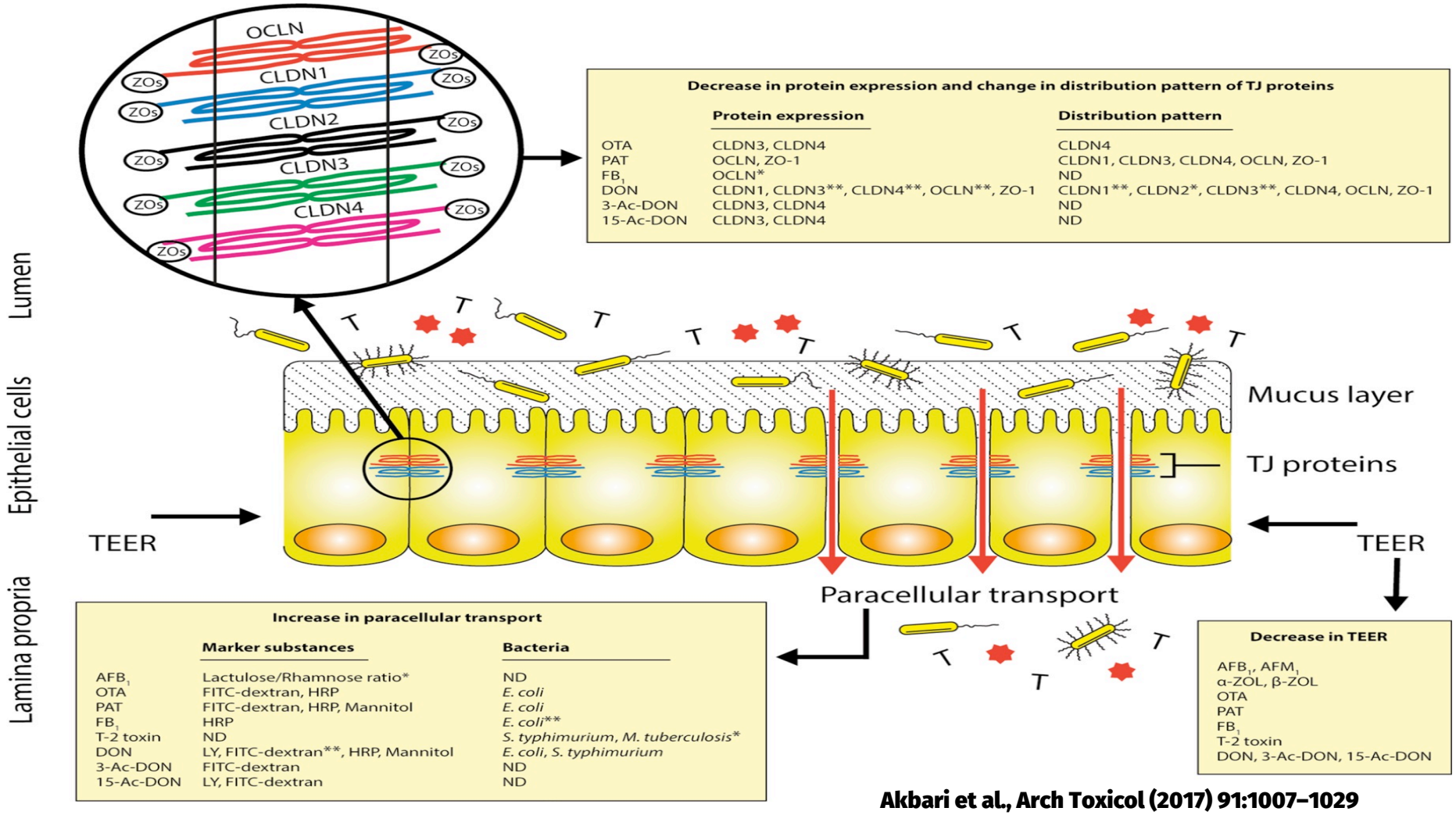


Figure 2. Reduction in feed intake (FI) and weight gain (WG) by dietary deoxynivalenol (DON) concentration. ΔFI = –5.64 × DON – 0.13 with $r^2 = 0.60$ and $p<0.001$; and ΔWG = –6.49 × DON + 0.93 with $r^2 = 0.61$ and $p<0.001$.

Mok CH, Rev Colomb Cienc Pecu 2013; 26:243-254.

Healthy Gut is essential for growth , development and immunity

mycotoxin effect gut barrier function



Decrease in protein expression and change in distribution pattern of TJ proteins

	Protein expression	Distribution pattern
OTA	CLDN3, CLDN4	CLDN4
PAT	OCLN, ZO-1	CLDN1, CLDN3, CLDN4, OCLN, ZO-1
FB_1	OCLN*	ND
DON	CLDN1, CLDN3**, CLDN4**, OCLN**, ZO-1	CLDN1**, CLDN2*, CLDN3**, CLDN4, OCLN, ZO-1
3-Ac-DON	CLDN3, CLDN4	ND
15-Ac-DON	CLDN3, CLDN4	ND

Increase in paracellular transport

	Marker substances	Bacteria
AFB_1	Lactulose/Rhamnose ratio*	ND
OTA	FITC-dextran, HRP	*E. coli*
PAT	FITC-dextran, HRP, Mannitol	*E. coli*
FB_1	HRP	*E. coli***
T-2 toxin	ND	*S. typhimurium, M. tuberculosis**
DON	LY, FITC-dextran**, HRP, Mannitol	*E. coli, S. typhimurium*
3-Ac-DON	FITC-dextran	ND
15-Ac-DON	LY, FITC-dextran	ND

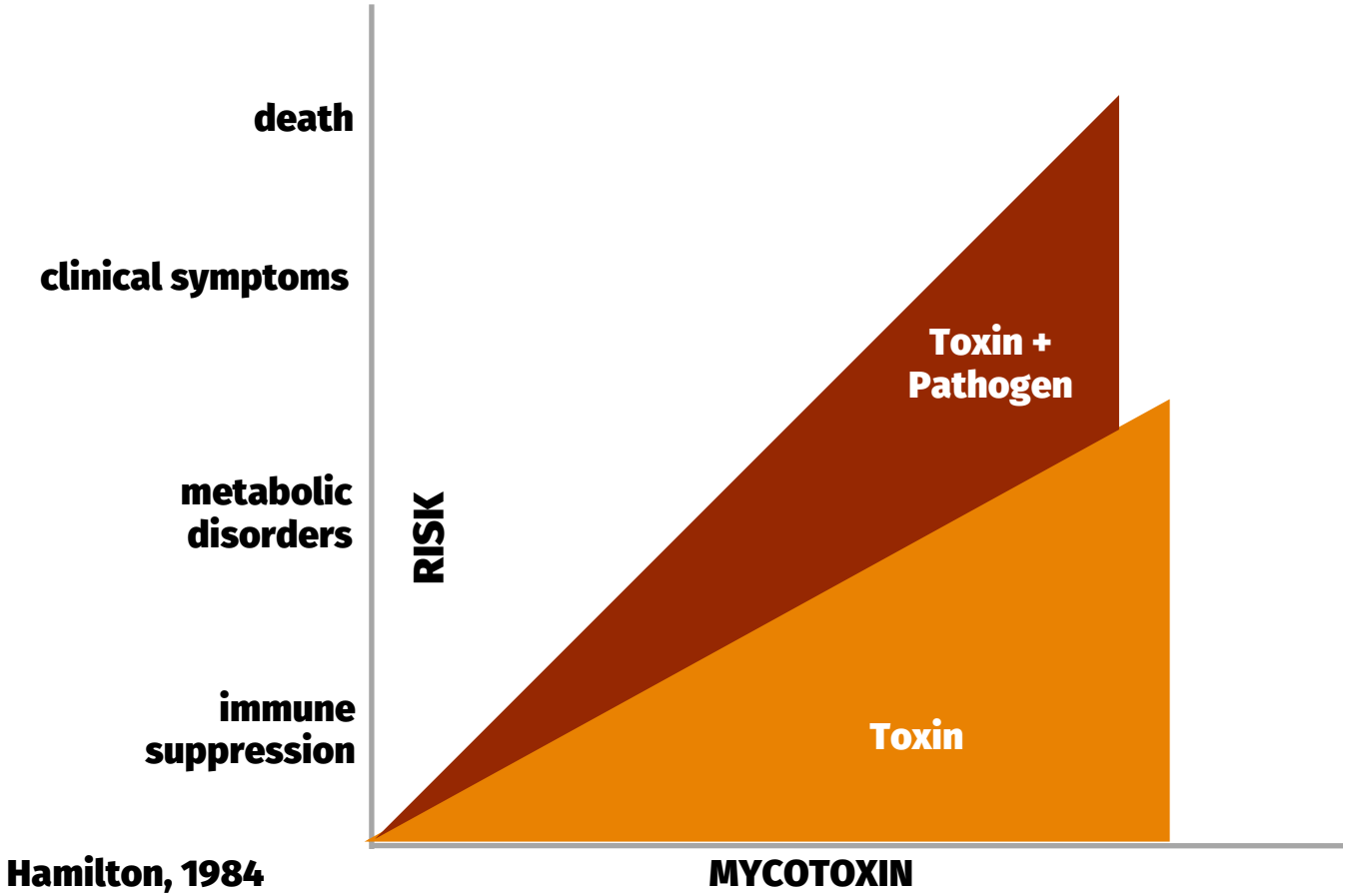
Decrease in TEER

AFB_1, AFM_1
α-ZOL, β-ZOL
OTA
PAT
FB_1
T-2 toxin
DON, 3-Ac-DON, 15-Ac-DON

Akbari et al., Arch Toxicol (2017) 91:1007–1029

There are no safe levels: effects can be already observed in the immune system at low mycotoxin levels

Severe economic losses!

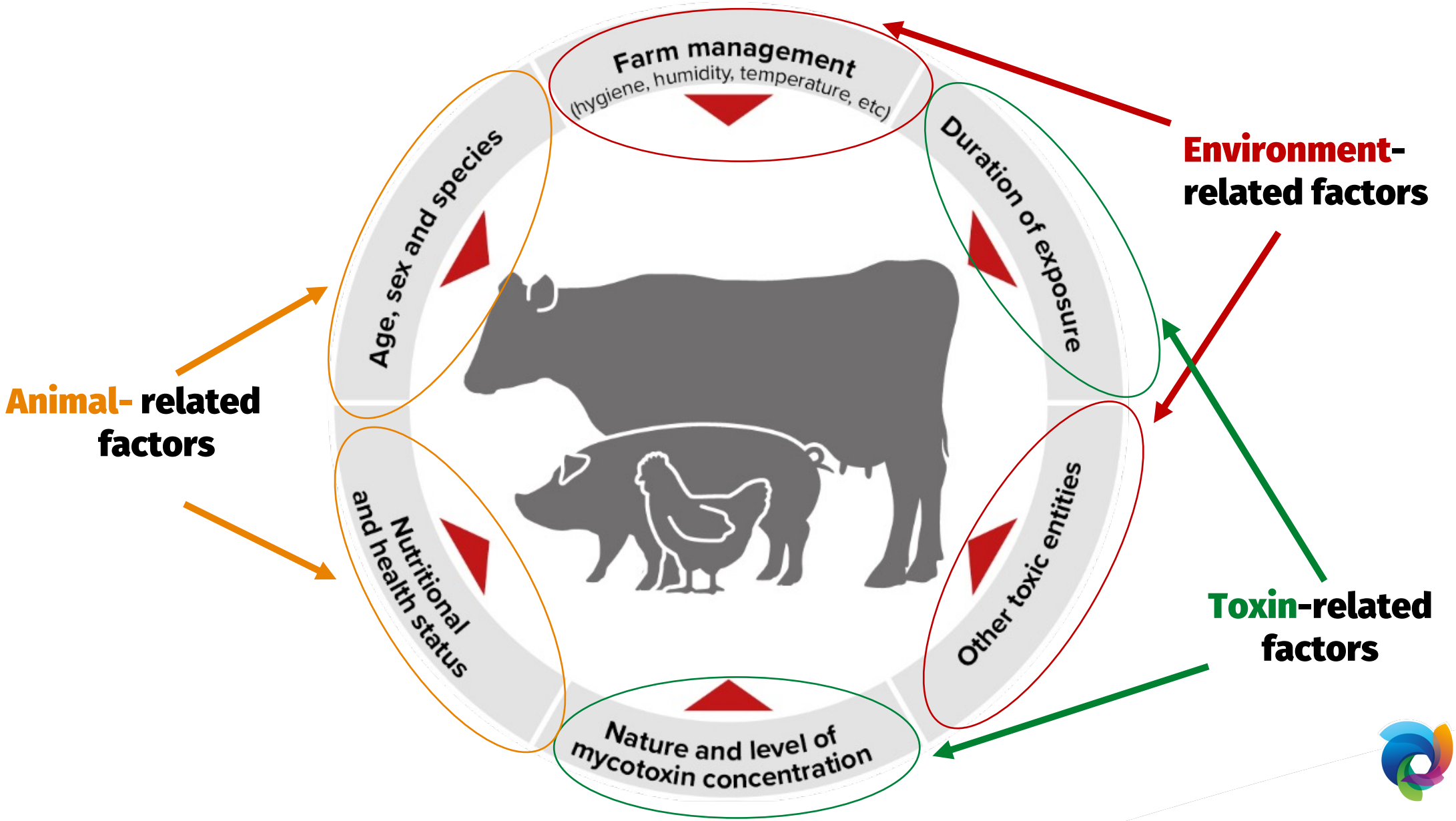


Hamilton, 1984

Consequences of immune suppression

- increased risk of infections
- more severe disease processes
- therapies become more difficult
- impaired vaccination response
- activation of tumour formation

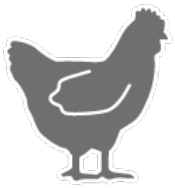
Severity of effects of mycotoxins depends on:

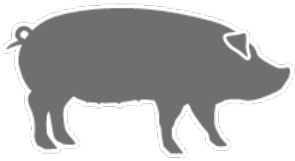


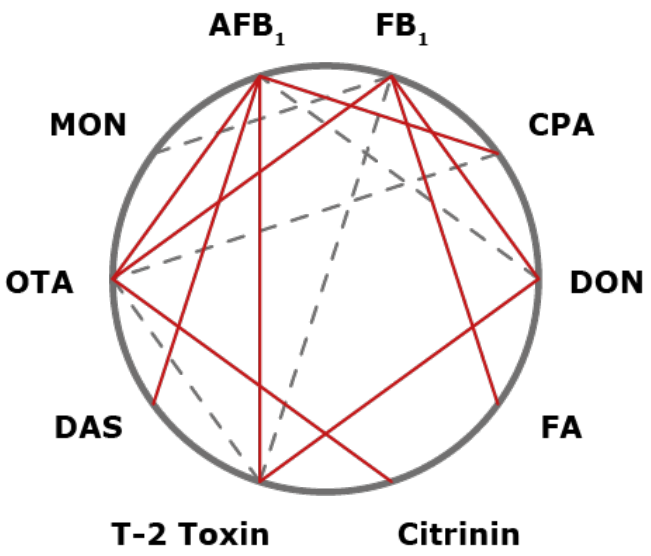
Co-Contamination → Synergism

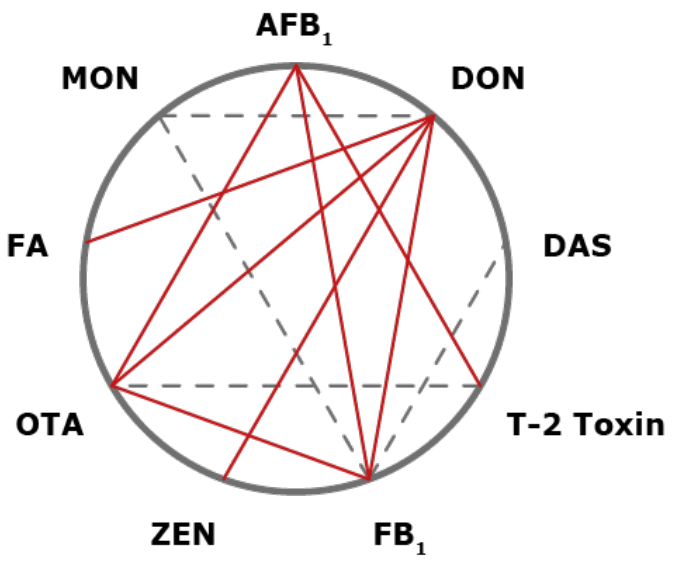
The severity of one mycotoxin can be increased by the presence of others:

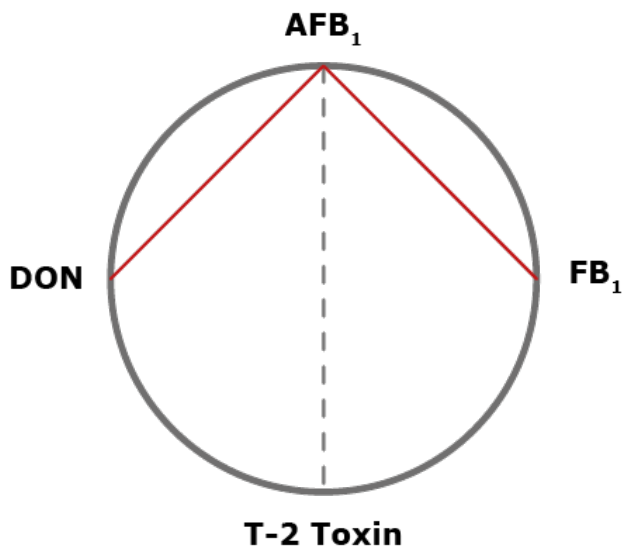
Additive (– –) and synergistic (——) effects can occur









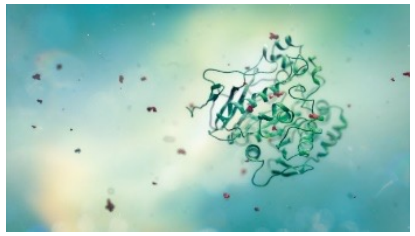


AFB1 - Aflatoxin B1 ; FB1 – Fumonisin B1 ; DON – Deoxynivalenol; OTA – Ochratoxin A; ZON – Zearalenone; FA – Fusaric acid; DAS – Diacetoxyscirpenol; CPA – Cyclopiazonic acid; MON – Moniliformin.

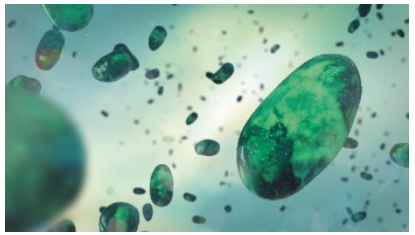
Mycofix® product line - The absolute protection against mycotoxins

Biotransformation

A unique combination of patented specific enzymes and biological components converts mycotoxins into nontoxic, environmentally-safe metabolites in the digestive tract of animals.



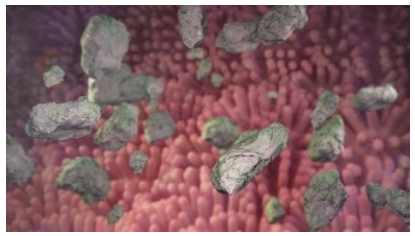
FUM*zyme*® - purified enzyme degrades FUM



Biomin® BBSH 797 DSM 11798 degrades trichothecenes

Biological constituent degrades ZEN

Adsorption



Synergistic blend of minerals

Adsorbs Aflatoxins, Ergot alkaloids and endotoxins

Bioprotection

Biomin® Bioprotection Mix

Supports the liver, immune system and intestinal integrity

Out of 500+, only 3 ingredients have been authorized by EU as mycotoxin deactivator

COMMISSION IMPLEMENTING REGULATION (EU) No 1060/2013

of 29 October 2013

concerning the authorisation of bentonite as a feed additive for all animal species

COMMISSION IMPLEMENTING REGULATION (EU) No 1016/2013

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Coriobacteriaceae family as

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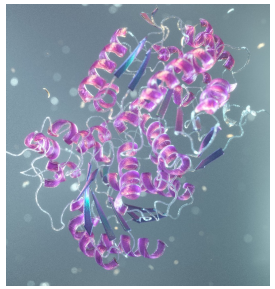
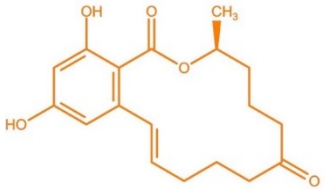
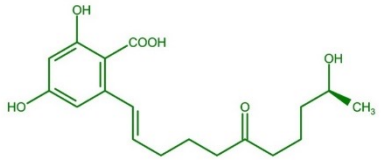
concerning the authorisation of a preparation of fumonisin esterase produced by *Komagataella phaffii* (DSM 32159) as a feed additive for all pigs and all poultry species

Positive EFSA opinion to be expected early 2022





ZENzyme®
purified enzyme to degrade ZEN

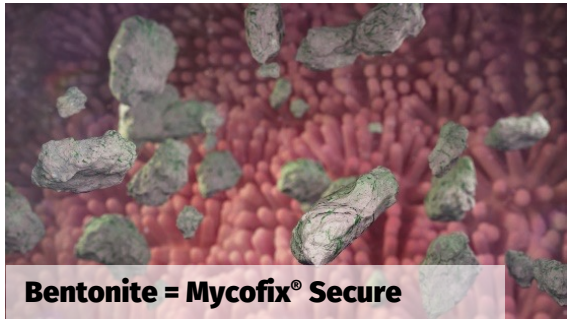


NEW!

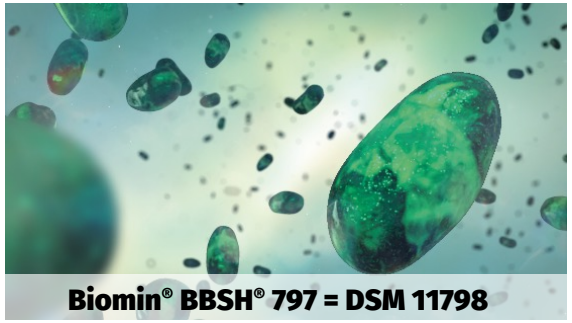
COMMISSION IMPLEMENTING REGULATION (EU) 2021/363

of 26 February 2021

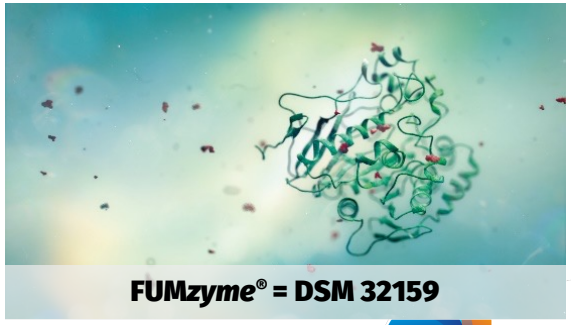
concerning the authorisation of a preparation of fumonisin esterase produced by *Komagataella phaffii* DSM 32159 as a feed additive for all animal species



Bentonite = Mycofix® Secure



Biomin® BBSH® 797 = DSM 11798



FUMzyme® = DSM 32159

1 (m) substances for the reduction of contamination of feed by mycotoxins

European Union

Register of Feed Additives

pursuant to Regulation (EC) No 1831/2003

Annex I: List of additives

All registrations in the 1(m) category were initiated by Biomin!!! – NO other company in Europe has a component registered to reduce mycotoxin contamination!!!

Category (Annex I of Reg. 1831/03)	Functional Group	Subclassification	Code	Additive	Reference(s) of Community legal act	Reference in OJ	Date of authorisation	Expiry date of authorisation(s)	Date of first entry in the Register
1	k	3 - Substances	E 250	Sodium nitrite	Reg. (EC) 1831/2003	OJ L 268, 18.10.2003, p. 29	07.11.2005	Following the provisions of Art. 10 § 7 of Reg. (EC) No 1831/2003, an application, in accordance with Article	07.11.05
1	m	Substances for the reduction of the contamination of feed by mycotoxins (trichothecenescarbonat)	1m01	Micro-organismstrain DSM 11798 of the *Coriobacteriaceae* family [Pigs]	Commission Implementing Regulation (EU) No 1016/2013 of 23 October 2013 / Amended by Commission Implementing Regulation (EU) No 2017/930 of 31 May 2017	OJ L 282, 24.10.2013, p. 36 / Amended by OJ L 141, 01.06.2017, p. 6	13.11.2013	13.11.2023	05.11.13
1	m	Substances for the reduction of the contamination of feed by mycotoxins (trichothecenes)	1m01	Micro-organismstrain DSM 11798 of the *Coriobacteriaceae* family [All avian species]	Commission Implementing Regulation (EU) No 2017/930 of 31 May 2017	OJ L 141, 01.06.2017, p. 6	21.06.2017	21.06.2027	07.06.17
1	m	Substances for the reduction of the contamination of feed by mycotoxins (fumonisins)	1m03	Fumonisin esterase EC 3.1.1.87 produced by *Komagataella pastoris* DSM 26643 [Pigs]	Commission Implementing Regulation (EU) No 1115/2014 of 21 October 2014	OJ L 302, 22.10.2014, p. 51	11.11.2014	11.11.2024	24.10.14
1	m	Substances for the reduction of the contamination of feed by mycotoxins (fumonisins)	1m03	Fumonisin esterase EC 3.1.1.87 produced by *Komagataella pastoris* DSM 26643 [All avian species]	Commission Implementing Regulation (EU) No 2017/913 of 29 May 2017	OJ L 139, 30.05.2017, p. 33	19.06.2017	19.06.2027	30.05.17
1	m	Substances for the reduction of the contamination of feed by mycotoxins (fumonisins)	1m03i	Fumonisin esterase EC 3.1.1.87 produced by *Komagataella phaffii* (DSM 32159) [All pigs; All poultry species]	Commission Implementing Regulation (EU) No 2018/1568 of 18 October 2018	OJ L 262, 19.10.2018, p. 34	08.11.2018	08.11.2028	19.10.18
1	m	Substances for the reduction of the contamination of feed by mycotoxins (fumonisins)	1m03i	Fumonisin esterase EC 3.1.1.87 produced by *Komagataella phaffii* (DSM 32159) [All animal species]	Commission Implementing Regulation (EU) No 2021/363 of 26 February 2021	OJ L 70, 01.03.2021, p. 3	21.03.2021	21.03.2031	01.03.21
1	m	Substances for reduction of the contamination of feed by mycotoxins (aflatoxin B1)	1m558	Bentonite [Ruminants, Poultry, Pigs]	Commission Implementing Regulation (EU) No 1060/2013 of 29 October 2013 / *Corrigendum* SL in OJ L10, 15.01.2014, p. 32	OJ L 289, 31.10.2013, p. 33 / *Corrigendum* SL OJ L10, 15.01.2014, p.	19.11.2013	19.11.2023	05.11.13
1	n	Hygiene condition enhancers	1k236	Formic acid	Commission Implementing Regulation (EU) 2017/940 of 1 June 2017	OJ L 142, 02.06.2017, p. 40	21.06.2017	21.06.2027	07.06.17
1	n	hygiene condition enhancer	1k237	Sodium formate [All animal species except pigs; Pigs]	Commission Implementing Regulation (EU) 2020/106 of 23 January 2020	OJ L 19, 24.01.2020, p. 15	13.02.2020	13.02.2030	24.01.20

Mycofix® Plus 5.E

1. Synergistic blend of minerals
2. FUM*zyme*®
3. Biomin® BBSH ® 797
4. Biological constituent
5. Biomin® Bioprotection Mix

Adsorbable mycotoxins
Afla, Ergots,
Endotoxins

Fumonisins

Trichothecenes
(DON, T-2, DAS)

Zearalenone

Liver protection
& Immune support

Dose recommendations

Mycofix® Plus 5.E

Contamination

Moderate: 0.5 – 0.75 kg/t

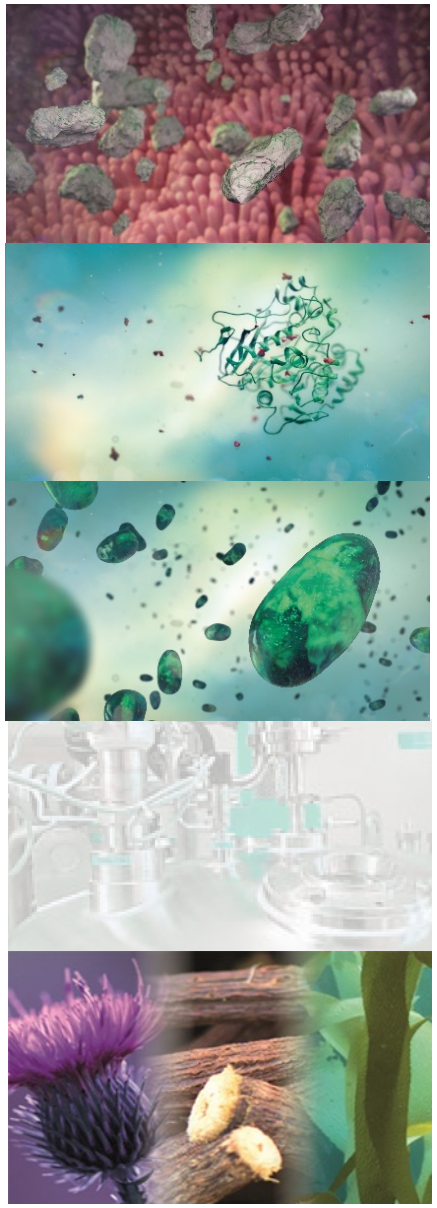
Medium: 1.0 – 1.5 kg/t

High: 2.0 kg/t

- Sows, gilts, piglets & boars
- Poultry breeders

Mycofix® Select 5.E

1. Synergistic blend of minerals
2. FUM*zyme*®
3. Biomin® BBSH ® 797
5. Biomin® Bioprotection Mix



Adsorbable mycotoxins
Afla, Ergots,
Endotoxins

Fumonisins

Trichothecenes
(DON, T-2, DAS)

Liver protection
& Immune support

DSM

Dose recommendations

Mycofix® Select 5.E

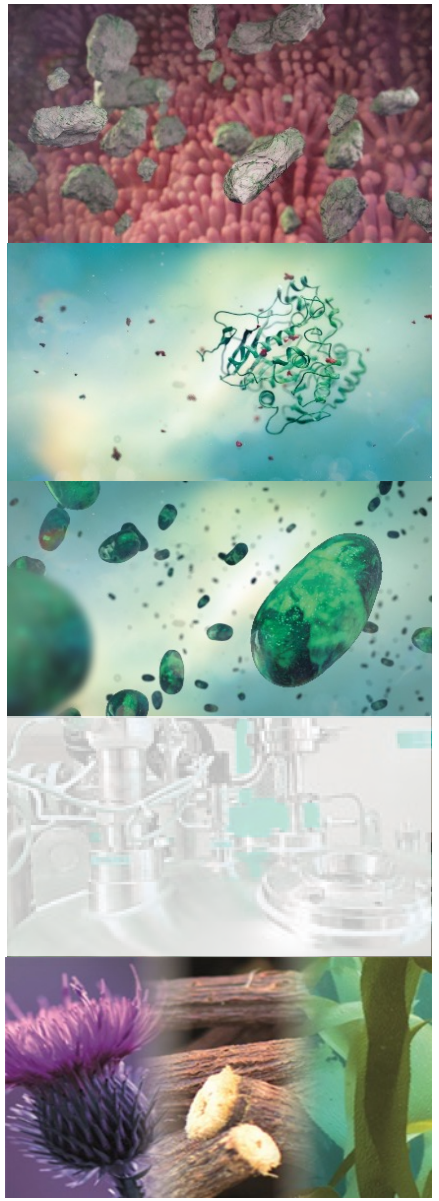
Contamination

Moderate: 0.5 – 0.75 kg/t

Medium: 1.0 – 1.5 kg/t

High: 2.0 kg/t

- Finishing pigs
- Pullets and laying hens
- Broilers, turkeys and ducks



Which mycotoxins are countered by Mycofix® Plus 5E ?

Adsorption

- **Aflatoxins:** AfB1, AfB2, AfG1, AfG2, AfM1, AfM2
- **Ergot alkaloids (30):** Ergovalin, Ergocryptine, Ergosin, Ergometrine, Ergotamine,..
- **Ochratoxins:** OTA, OTB
- **Roquefortine C**
- **Mycophenolic Acid**
- **Fusaric Acid**
- **Cyclopiazonic Acid**
- **Pyrrolizidine Alkaloids**
- **Endotoxins**

Biotransformation

- **Type A Trichothecenes:** T-2 toxin, HT-2 toxin, DAS, FusX,…
- **Type B Trichothecenes:** DON, NIV, 3ADON, 15ADON, DON-3-Glucoside,…
- **Other Trichothecenes:** Calonectrin, Decalonectrin, Satratoxin,…
- **Zearalenone and metabolites (9):** ZEN, alpha and beta zearalenol, ZEN-Glucosides, ZEN-Sulfate,…
- **Fumonisins:** FB1, FB2, FB3, FB4, FB6
- **Ochratoxins:** OTA, OTB, OTC

> 200 mycotoxins!

Bioprotection

- Protection against toxic effects on the liver
- Support of gastrointestinal integrity
- Immune support