Invisible Threats in South African Feedlots: Managing Mycotoxins for Sustainable Profit

Sander Janssen, DVM

Mycotoxin Risk Management EMEA

29th of July 2026

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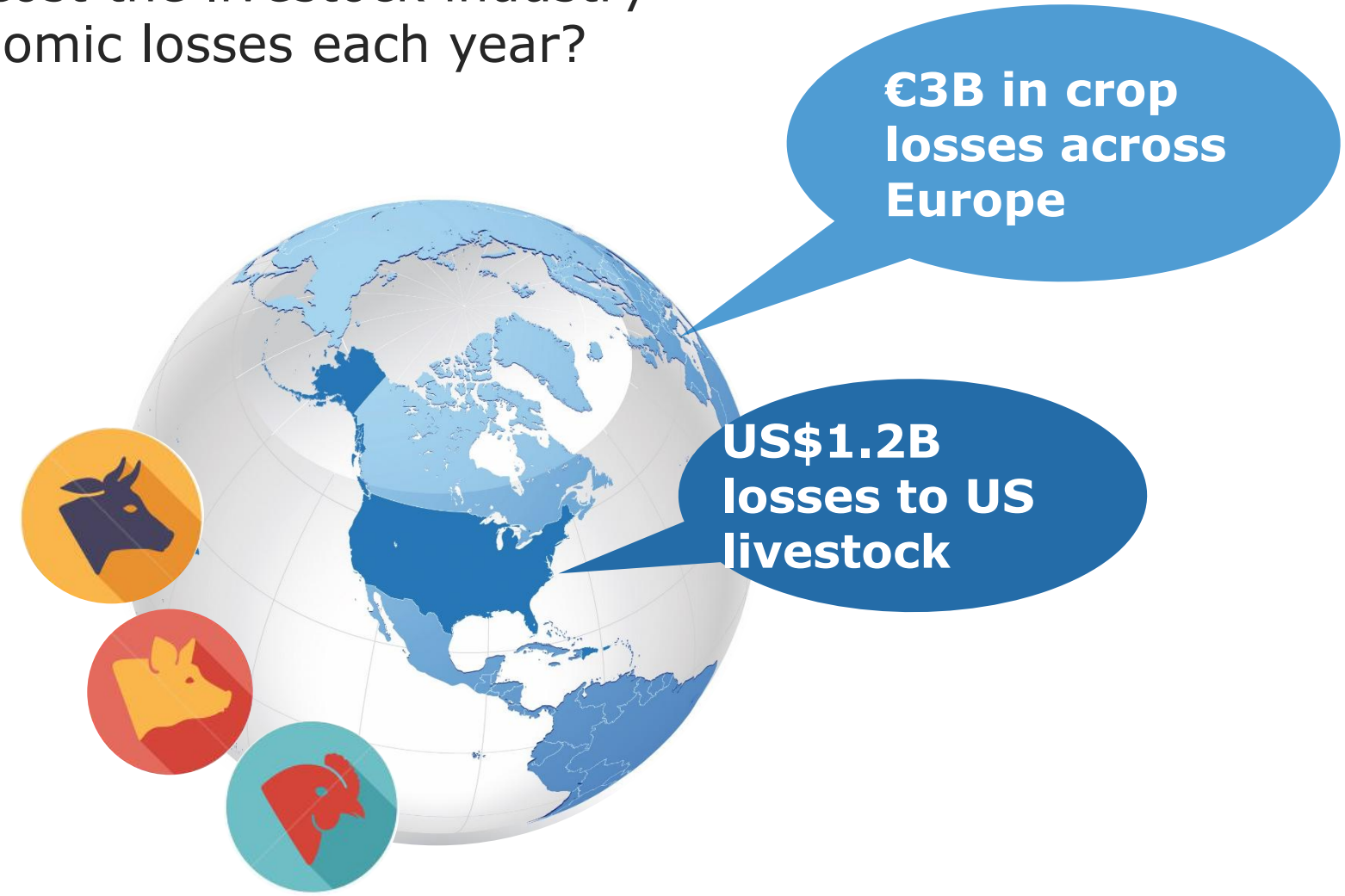
Content

- Challenges of mycotoxins
- Mycotoxin contamination risk in ZA
- How mycotoxins hurt beef cattle (producers)?
  - From rumen function to systemic effects
- Mycotoxin Risk Management

Did you know that…

… Mycotoxins cost the livestock industry billions in economic losses each year?



Challenges in Beef Cattle

Consequences of Challenges…

Lungs → 32,3%

- 22,5% - mild lesions
- 9,8% - severe lesions (-0,07Kg ADG and -7,1 kg HCW)

Liver → 31,4%

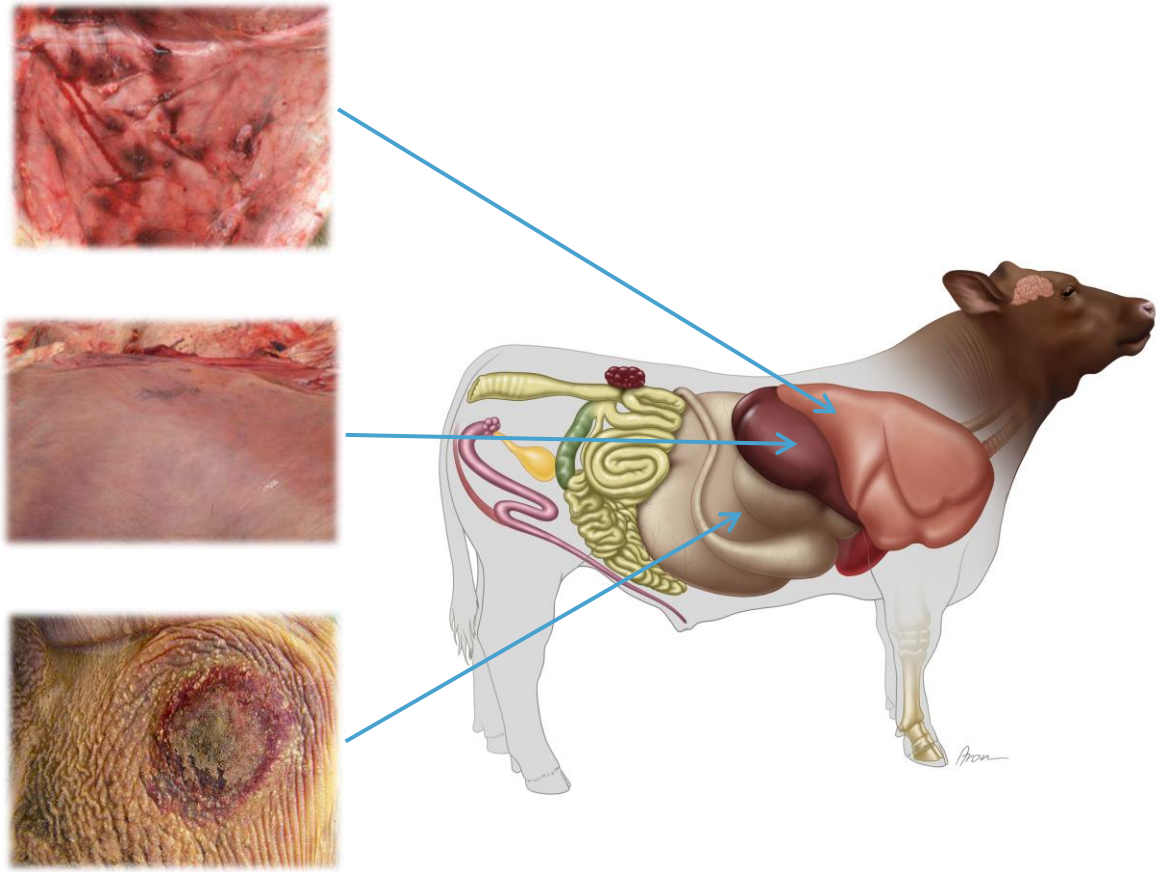
- 4,6% Severe abscesses (-0,025 ADG and -2,2 kg HCW)

Rumen → 24,1%

- 24,1% Rumenitis

Globally

- 22,9% has ***at least one severe lesion*** (Rumen/liver/lungs)



Monitoring at slaughter is opportunity to improve beef cattle health, well being and productivity!

What about mycotoxins ?

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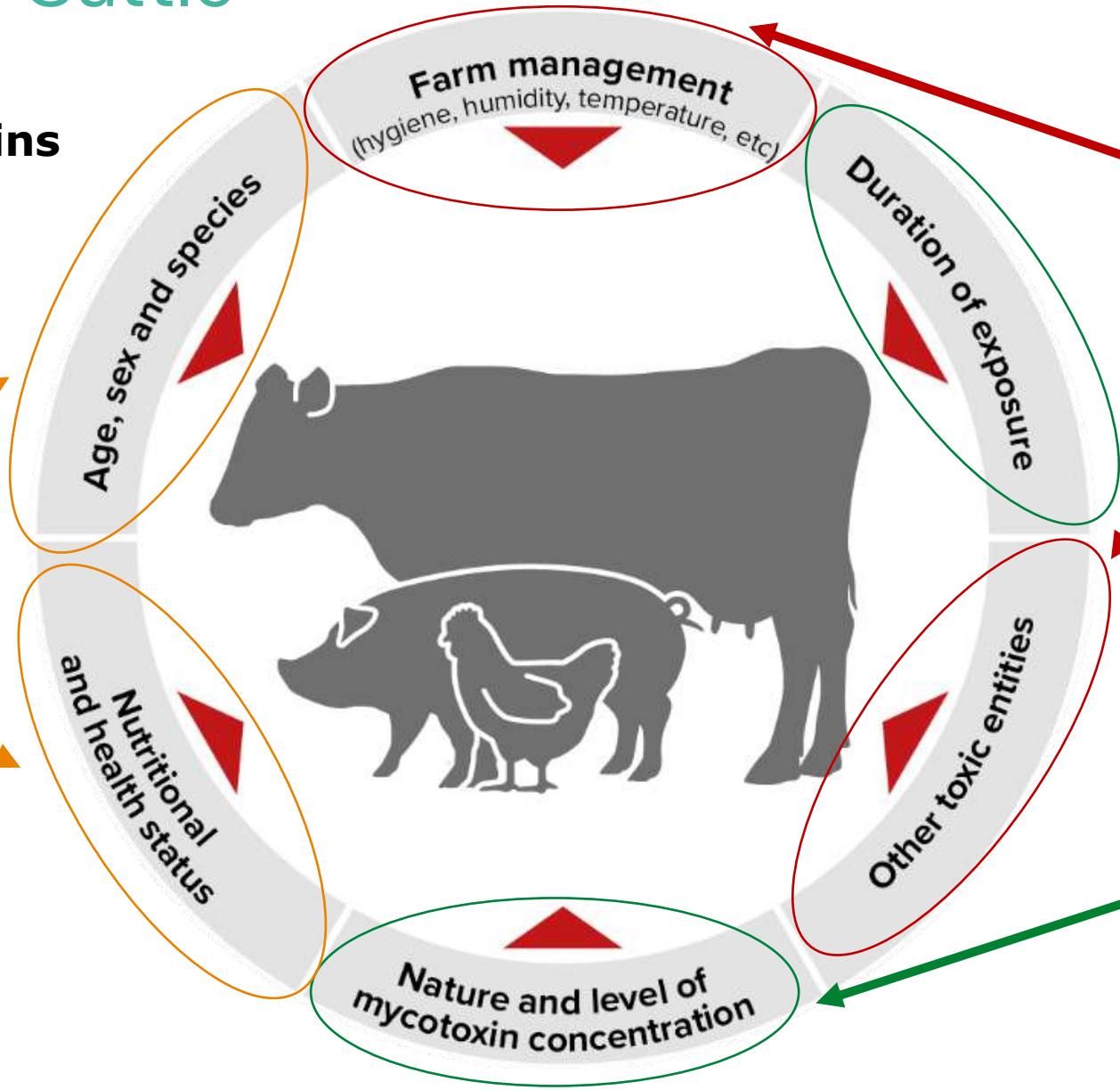
US Survey on 19,229 beef cattle at the slaughterhouse (Rezac et al. J. Anim. Sci. 2014.92:2595–2602)

Challenges in Cattle

Effects of (myco)toxins depend on:



Environmental-factors

Animal-factors

Toxin-factors

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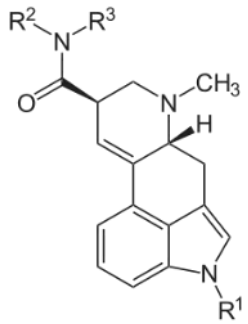
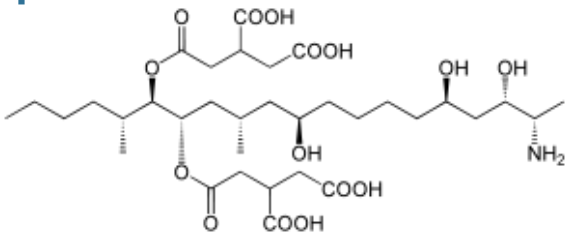
Challenges in Cattle

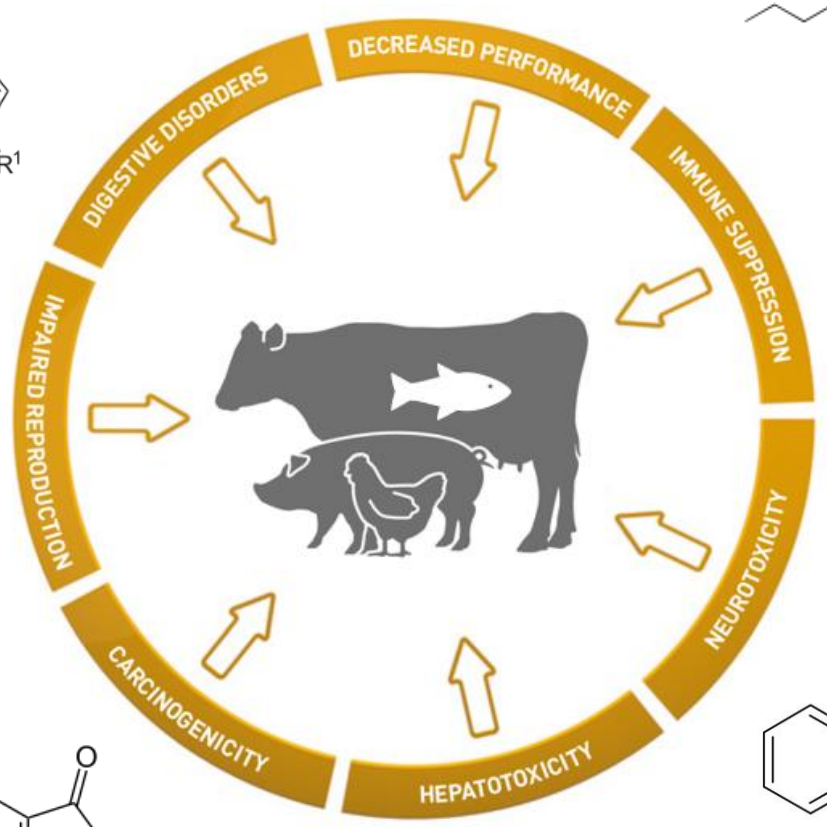
Mycotoxin Research

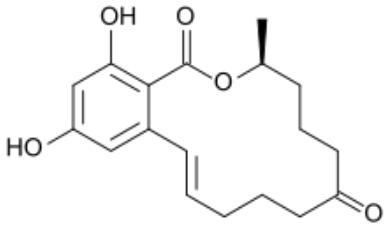


Ergot alkaloids

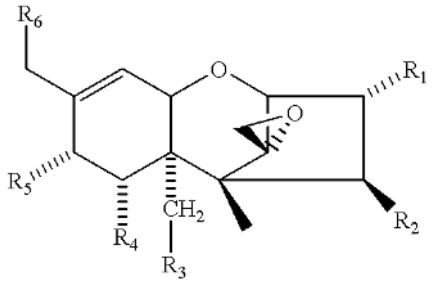


Fumonisins

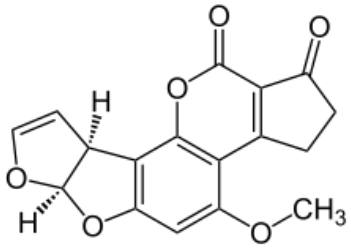




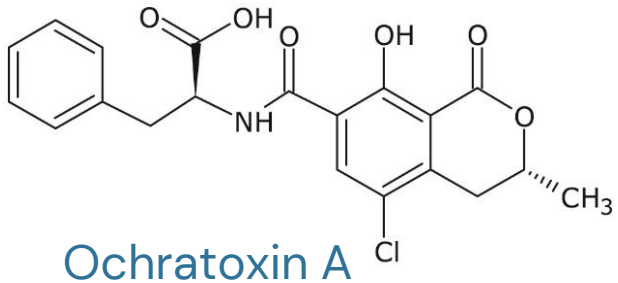
Zearalenone



Trichothecenes



Aflatoxins



Ochratoxin A

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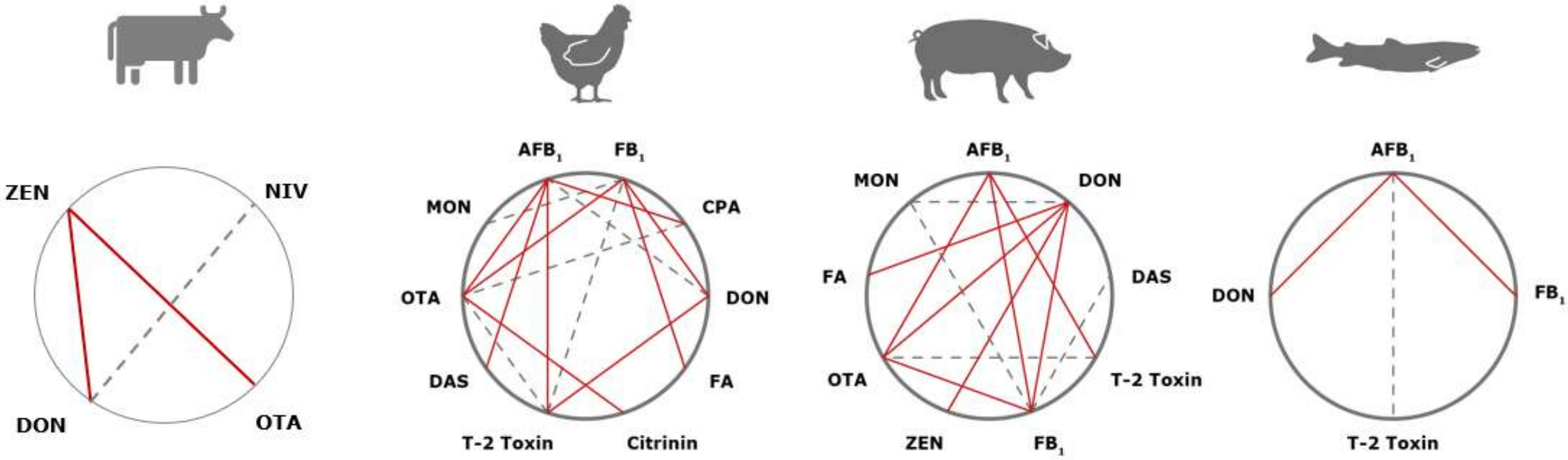
Challenges in Cattle

Co-Contamination (rations)

The severity of one mycotoxin can be increased by the presence of others:
Due to **additive** (– – –) & **synergistic** (——) effects



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

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Challenges in Cattle

- **95%** of mycotoxin come **from field** by fusarium spp.
- Mycotoxins of fusarium spp. often found in stored roughages/silages **without fusarium fungi visible**
  - Mycotoxins are **not visible, no taste, no odour**
- **No adequate** mycotoxins **test** used
  - Just e.g. DON, ZEN, or few main ones
  - ELISA versus feed matrix
- **Subclinical** symptomatology

Result: Herd productivity & health losses ***not*** linked to mycotoxin exposure!

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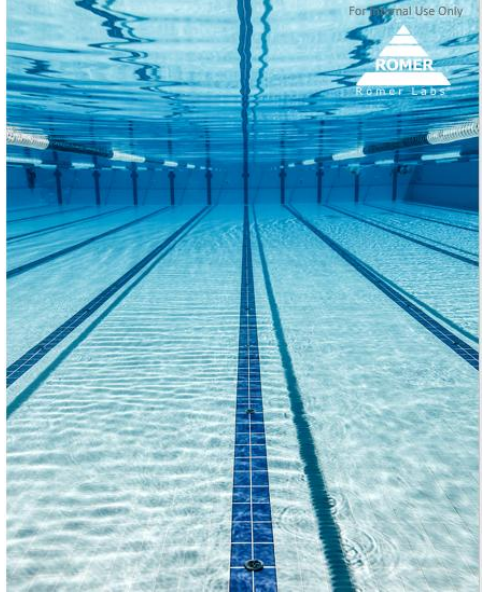
Mycotoxin Analysis: Sampling

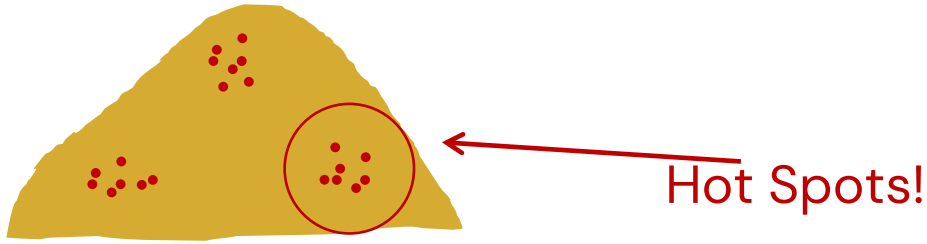
Analysis can be only as good as the sampling

ppb=µg/kg
1 gram of sugar
in a swimming pool

(50 m x 10 m x 2 m=
1000 m³ =1000.000l =
1000.000 kg = 1000 mt)



Uneven distribution of MYCOTOXINS in grains



Based on EU regulations:

1. Collect incremental samples (1 kg) according to lot weight

2. Mix incremental samples to form the aggregate sample: >3 kg

3. Lab sample: Collect scoops from different points in the aggregate (1 kg)

4. Send samples to lab for analysis

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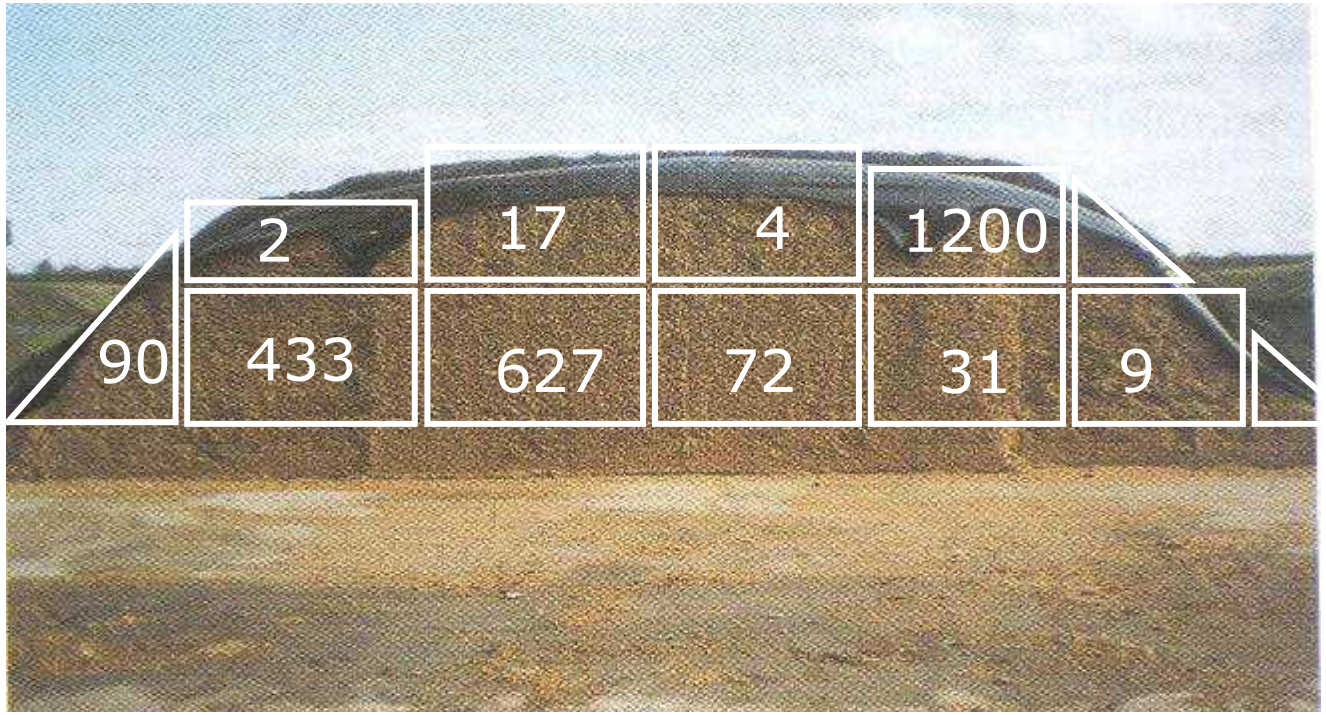
Importance of Proper Sampling

Get a homogeneous sample!

Maize silage cutting edge sample



- Make ≥ 8 quadrants on surface of maize silages
- Take from every quadrant one subsample
- Mix subsamples to one homogeneous overall samples (≥ 1 kg)

- Puncture plastic cover with sharp cone-shaped sampling device
- Refill holes cautiously and cover with strong tape

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Importance: Use Right Mycotoxin Analytical Method

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:
Simultaneous detection of multiple toxins in a wide variety of commodities

spectrum TOP 50

- **Sensitive method**
- **Suitable for various feed matrices**
- **Detection of masked & emerging mycotoxins**

- Highly qualified operator needed
- More expensive

Why advanced detection with Multi-mycotoxin analysis methods ?

Spectrum Top® 50

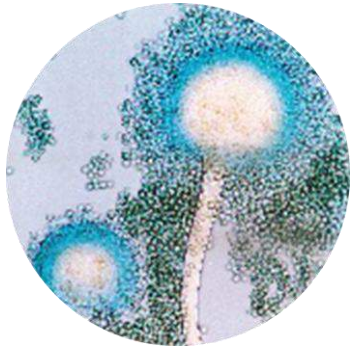
> 50 different mycotoxins and metabolites

- main mycotoxins
- frequently occurring mycotoxins
- masked mycotoxins
- emerging mycotoxins
- other secondary metabolites

Main Mycotoxins
- Aflatoxins
- Zearalenone-metabolites
- A-Trichothecenes
- B-Trichothecenes
- Fumonisins
- Ochratoxins
- Ergot alkaloids

Other Mycotoxins & Metabolites
- Alternaria Toxins
- Aspergillus Toxins
- Enniatins and Beauvericin
- Fusarium Metabolites
- Penicillium Toxins


Alternaria sp.


Aspergillus sp.


Claviceps sp.


Fusarium sp.

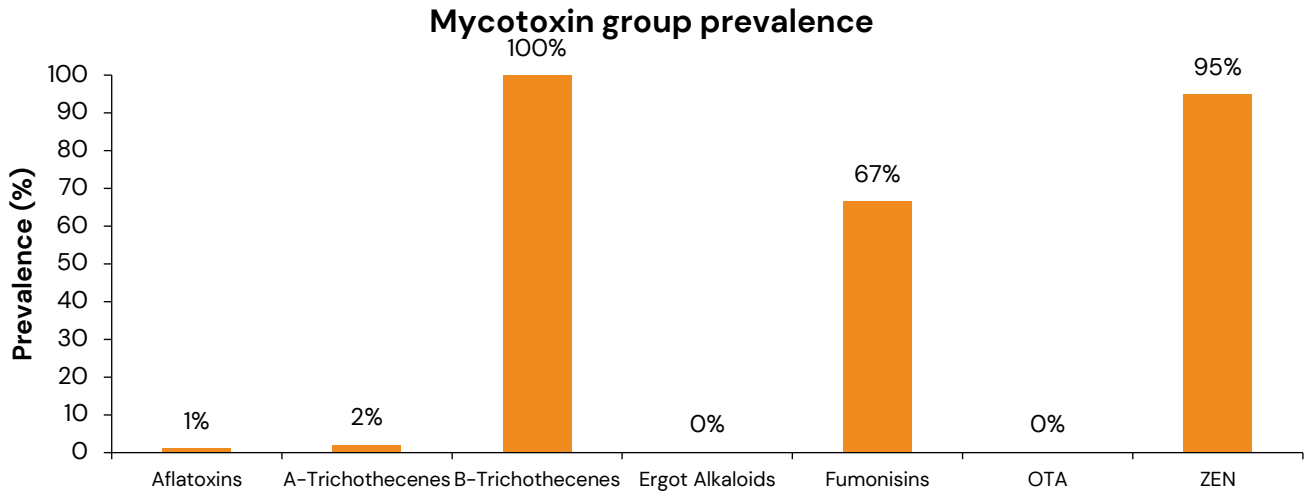

Penicillium sp.

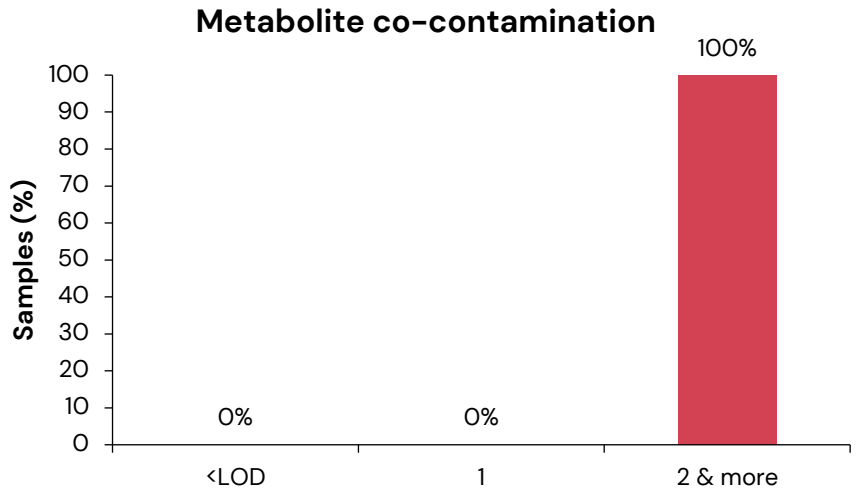
Mycotoxins Contamination & Risk ZA

Contamination overview

Corn kernels (whole)/meal (ground) from ZA between Aug 2025 - Jul 2026 (Spectrum Top®50)

	Aflatoxins	A-Trichothecenes	B-Trichothecenes	Ergot Alkaloids	Fumonisins	OTA	ZEN
Total samples	426	426	426	426	426	426	426
Prevalence	1%	2%	100%	0%	67%	0%	95%
% Above risk threshold	0%	0%	98%	0%	15%	0%	53%
Average of positives (ppb)	1	13	2,235	71	654	1	115
Median of positives (ppb)	0	5	1,656	71	67	1	57
Maximum (ppb)	2	40	93,967	71	39,086	1	4,169





Detailed filter values can be found in the speaker notes below.

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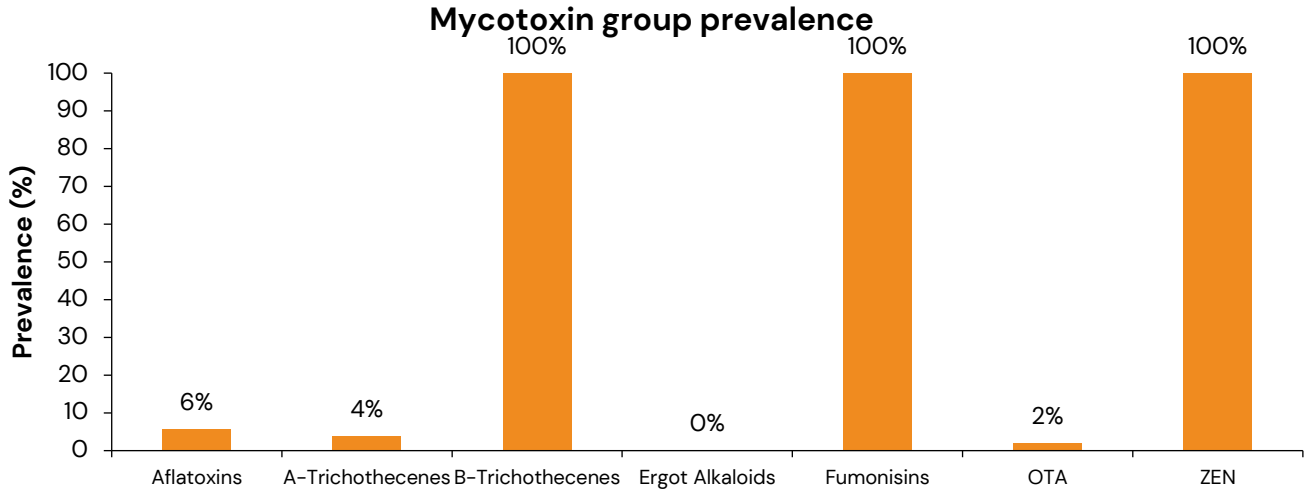
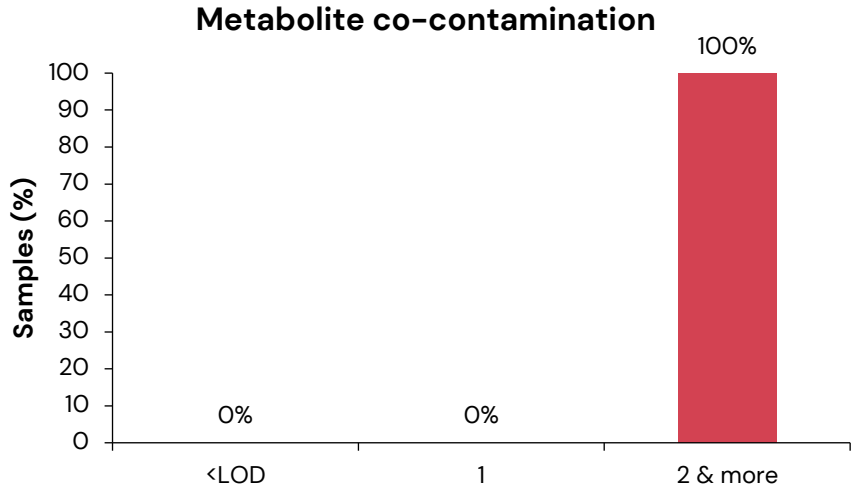
Contamination overview

Hominy Chop from ZA between Aug 2025 - Jul 2026 (Spectrum Top®50)

	Aflatoxins	A-Trichothecenes	B-Trichothecenes	Ergot Alkaloids	Fumonisins	OTA	ZEN
Total samples	53	53	53	53	53	53	53
Prevalence	6%	4%	100%	0%	100%	2%	100%
% Above risk threshold	0%	0%	100%	0%	81%	0%	94%
Average of positives (ppb)	0	25	6,737		2,015	1	304
Median of positives (ppb)	0	25	5,477		1,662	1	172
Maximum (ppb)	0	25	28,654		7,696	1	3,773





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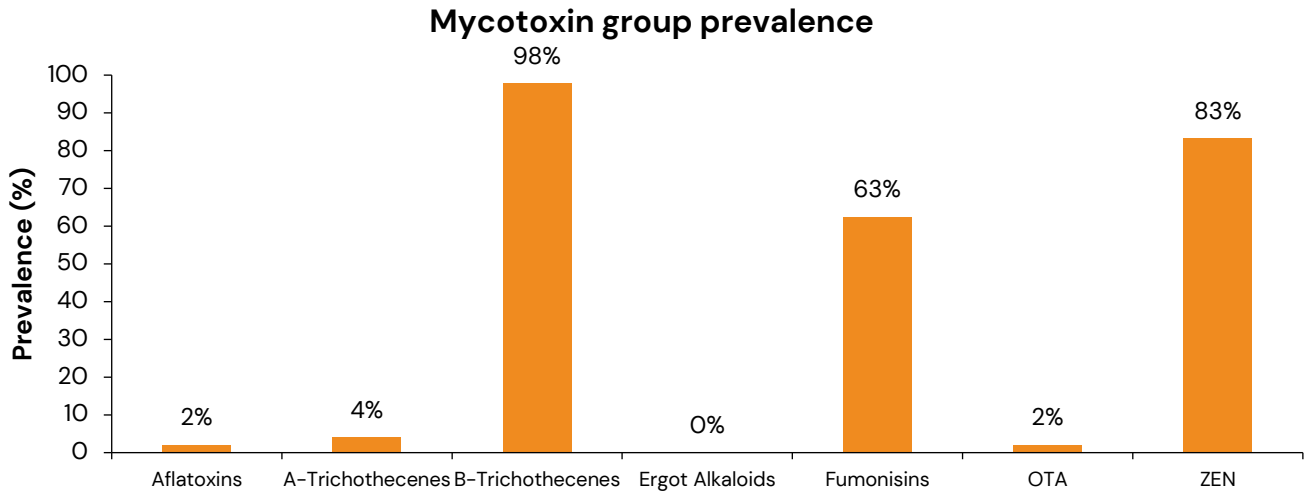
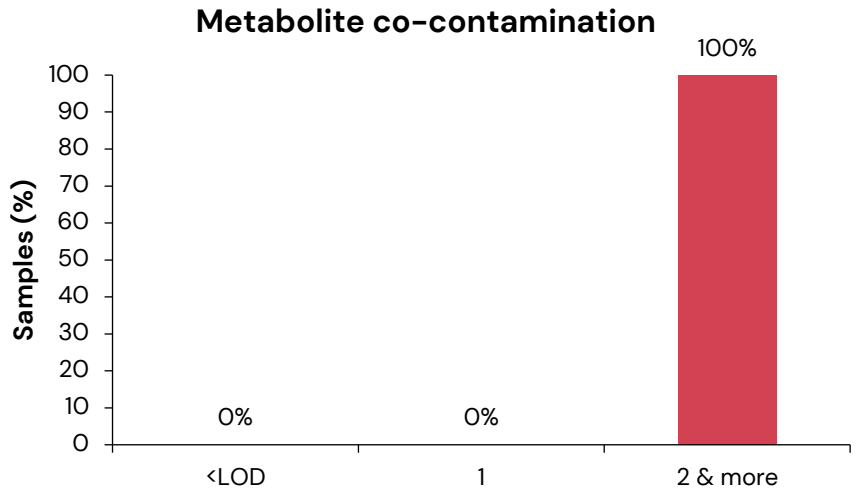
Contamination overview

Corn Silage from ZA between Aug 2025 - Jul 2026 (Spectrum Top®50)

	Aflatoxins	A-Trichothecenes	B-Trichothecenes	Ergot Alkaloids	Fumonisins	OTA	ZEN
Total samples	48	48	48	48	48	48	48
Prevalence	2%	4%	98%	0%	62%	2%	83%
% Above risk threshold	0%	0%	90%	0%	2%	0%	65%
Average of positives (ppb)	1	25	1,027		71	2	272
Median of positives (ppb)	1	25	943		69	2	118
Maximum (ppb)	1	25	4,600		594	2	2,579





Detailed filter values can be found in the speaker notes below.

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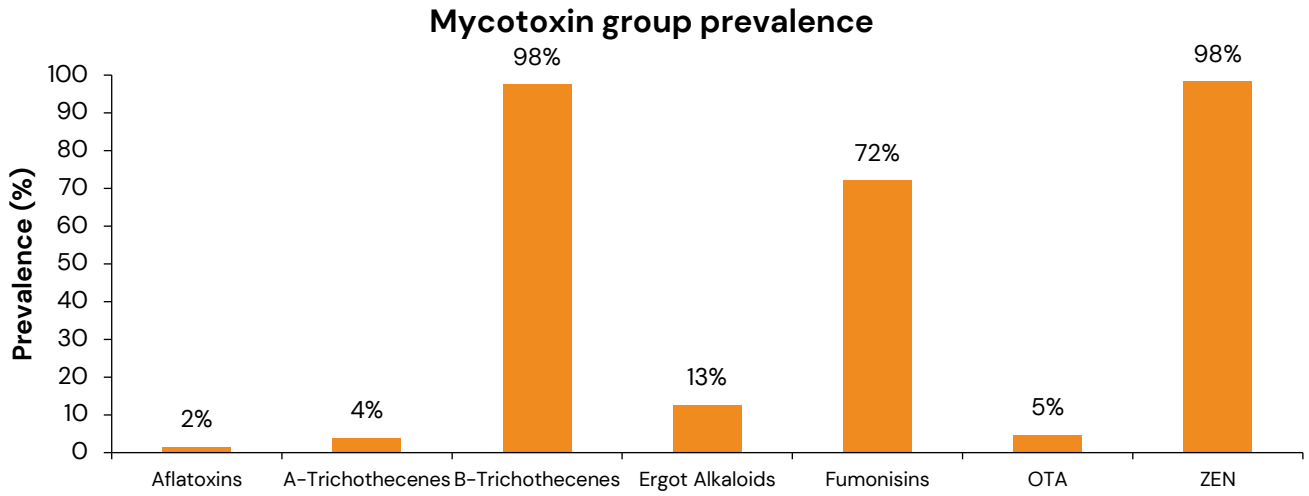
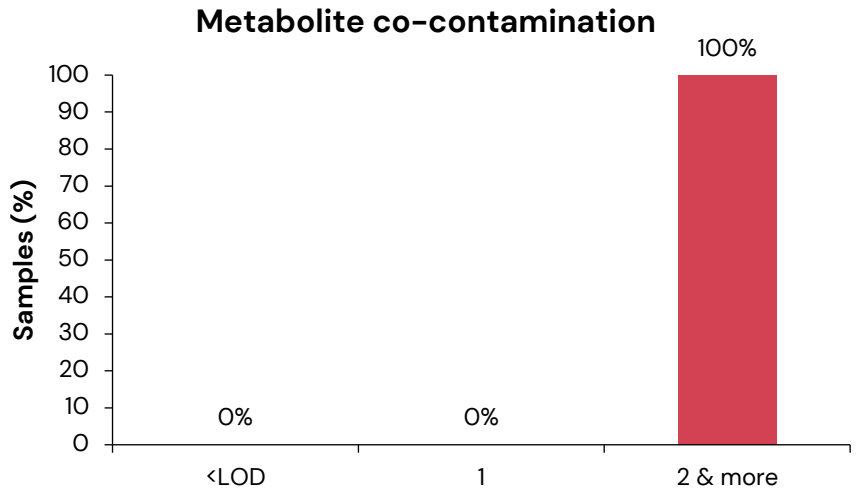
Contamination overview

Feed - TMR (Total Mixed Ration Ruminant) from ZA between Aug 2025 - Jul 2026 (Spectrum Top®50)

	Aflatoxins	A-Trichothecenes	B-Trichothecenes	Ergot Alkaloids	Fumonisins	OTA	ZEN
Total samples	126	126	126	126	126	126	126
Prevalence	2%	4%	98%	13%	72%	5%	98%
% Above risk threshold	1%	0%	86%	2%	8%	0%	53%
Average of positives (ppb)	2	33	1,513	38	196	2	128
Median of positives (ppb)	2	37	550	25	65	3	54
Maximum (ppb)	3	41	34,461	127	2,229	4	2,413





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Animal response to mycotoxin

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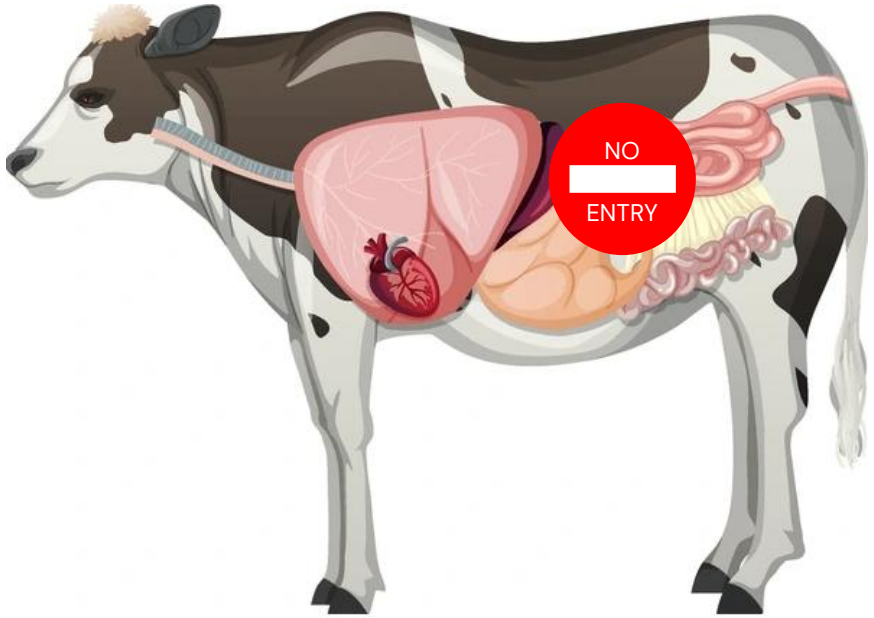
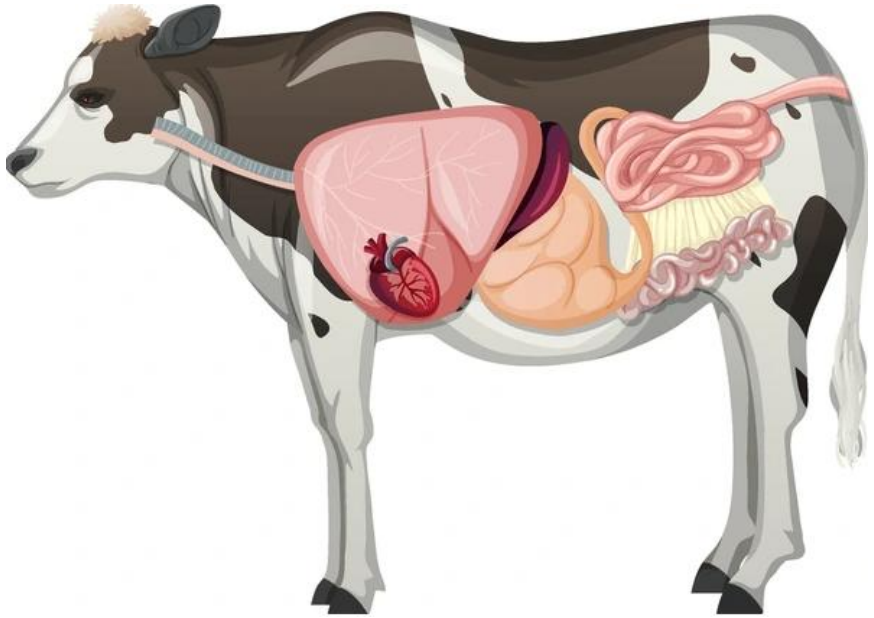
2 Effects on Cattle



Mythe:

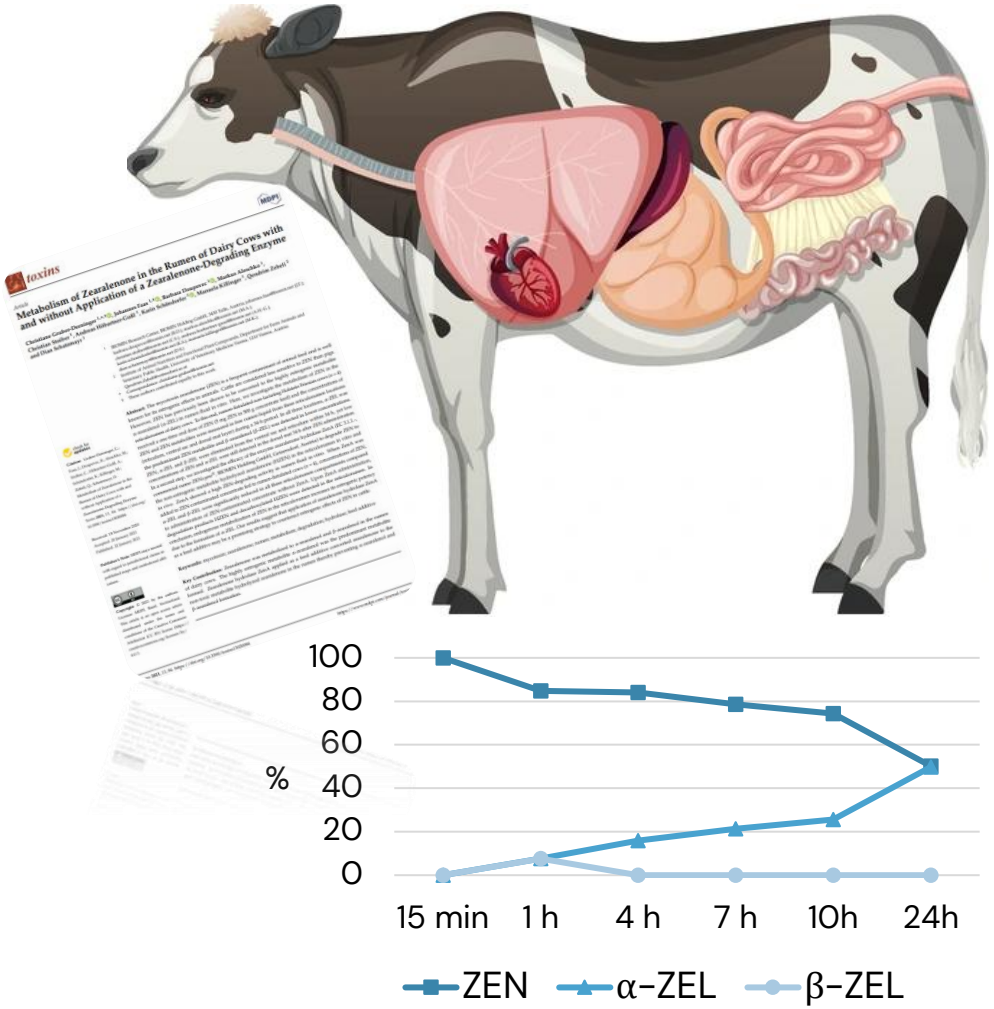
“Ruminants are fully protected due to their rumen”

2 Effects on Cattle



Mycotoxin	*"Metabolized" in rumen*	Reference
Aflatoxin	0 - 42 %	Engel and Hagemeister, 1978
Zearalenone	50 %	Gruber-Dorninger et al., 2021
Deoxynivalenol	15 % - 99 %	Cote et al., 1986; Kiessling et al., 1984, Debevere, 2020
Ochratoxin A	90 - 100 %	Mobashar et al., 2010
Fumonisin	0 %	EFSA, 2018
Enniantin B	1 - 25 %	Debevere et al., 2020

2 Effects on Cattle



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HIGHER TOXIC METABOLITES

Aflatoxicol, α-ZEL

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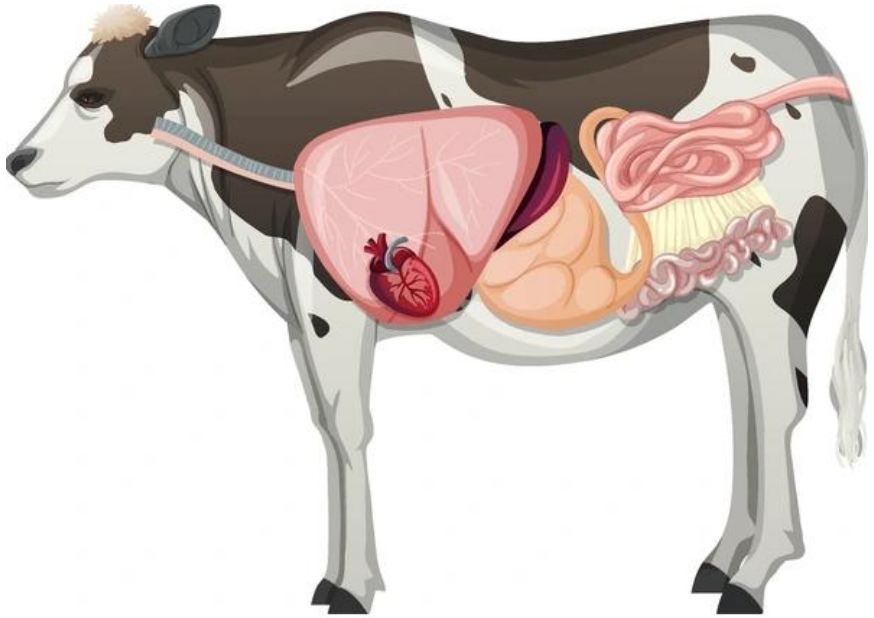
2 Effect on Cattle



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Certain level of detoxification?

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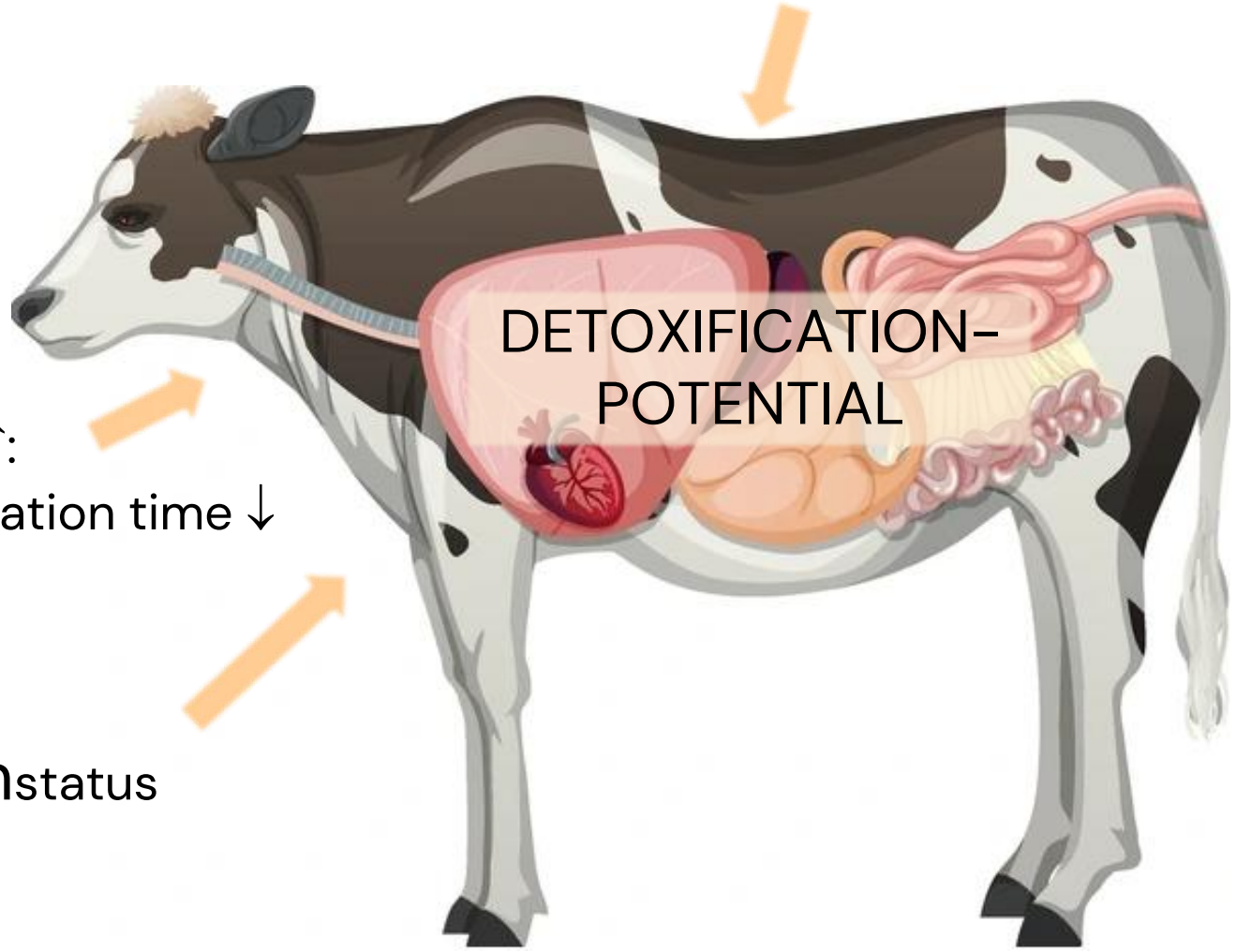
2 Effect on Cattle

SARA (subacute ruminal acidosis): pH ↓ →
Change in rumen microbiota



Stress
(e.g. heat)

FEED intake ↑:
Passage/Detoxification time ↓

Mycotoxin/-
concentration
(e.g. antibacterial)

General
Healthstatus

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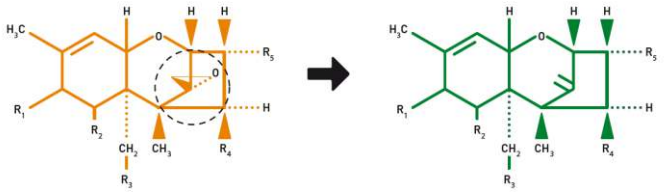
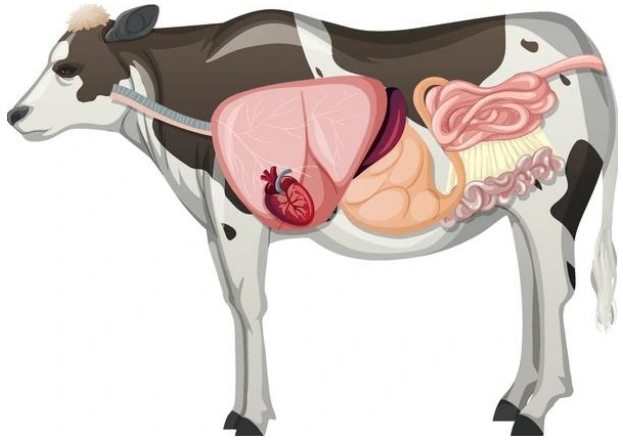
Effect on Cattle

Detoxification in rumen

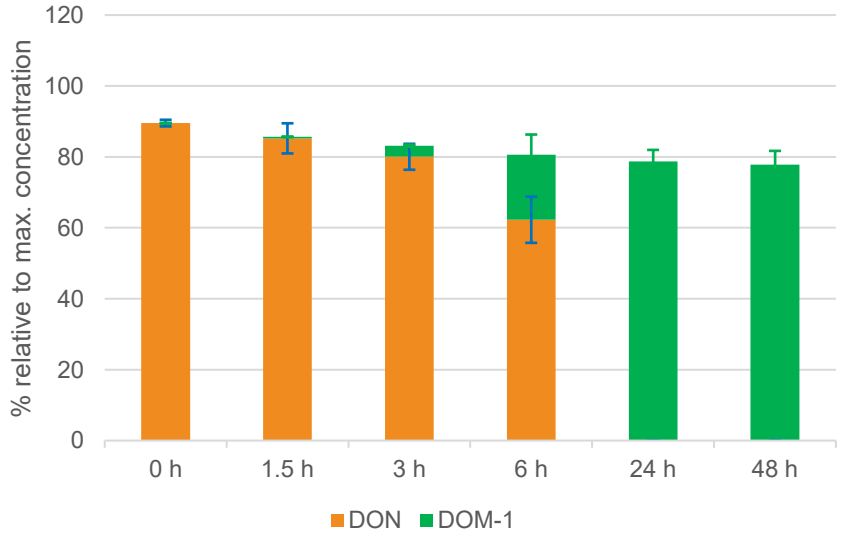


Deoxynivalenol → Deepoxydeoxynivalenol

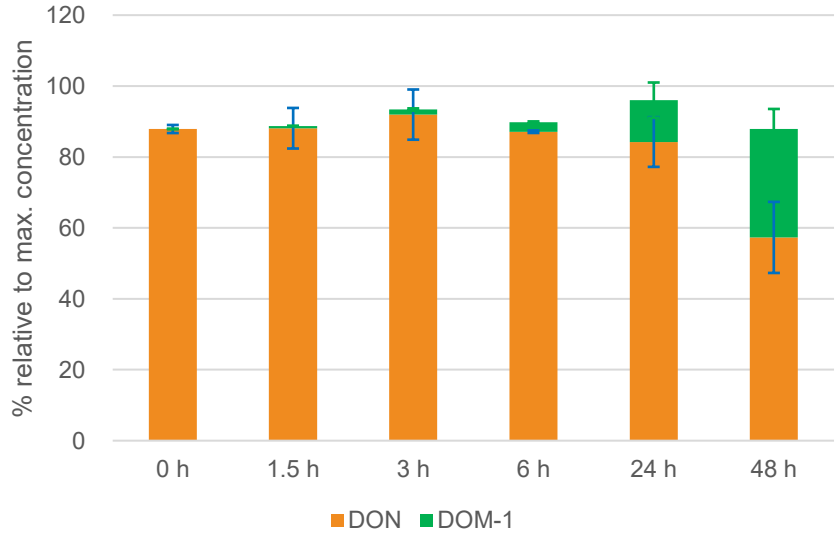


SARA

Normal pH (~ 6.8)



pH (< 5.8)



GHENT UNIVERSITY

Significant decline of detoxification at SARA conditions

Deoxynivalenol

Nivalenol

Enniatins

(also zearalenone)

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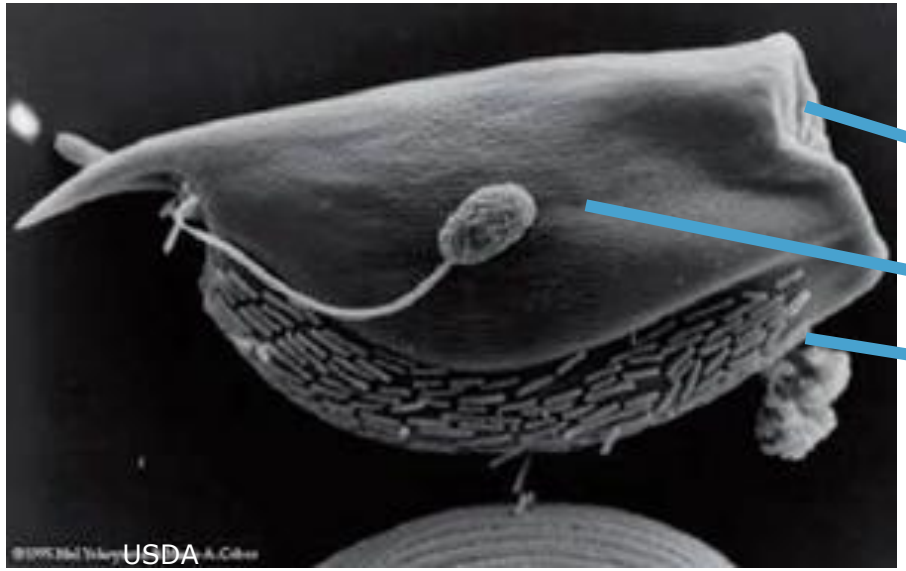
Debevere *et al*. Toxins 2020, 12(2),101. doi: 10.3390/toxins12020101,

Effect on Cattle

Mycotoxins disturb rumen function

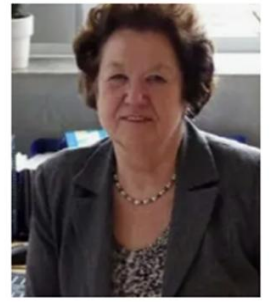


Antiprotozoal-

Antifungal-

Antibacterial effects

- Decline in rumination activity and feed intake
- Reduced fiber and starch digestion
- Negative effect on SCFA production
- Reduced protein synthesis in rumen



J. Fink-Gremmels professor. dr.
Faculty of Veterinary Medicine
Utrecht University
Utrecht, Netherlands

The role of mycotoxins in the health and performance of dairy cows

J Fink-Gremmels [1]

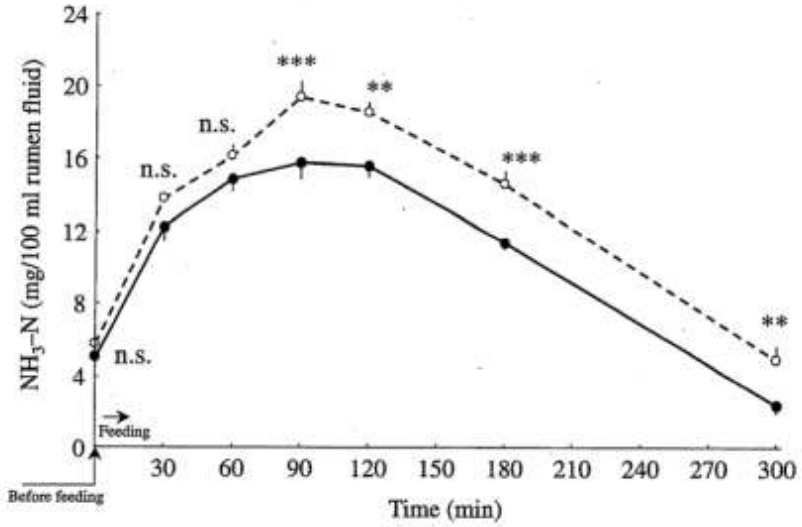
Effect on Cattle

Dr. Sven Dänicke

[Friedrich-Loeffler-Institut Germany]

Change in **duodenal protein-*flow*** in cows exposed to DON

Duodenal Flow	Control	DON 3.1 ppm	
Microbial protein (g/d)	862	680	↓ 21%
Microbial Protein (g/MJ ME)	10,9	8,3	↓ 24%



Rumen ammonia levels post-feeding a control diet (dashed) or DON contaminated (bold) diet

Conclusion:
Reduction microbial and utilizable protein at the duodenum due to reduced synthesis in rumen. Inefficiency in nitrogen usage.

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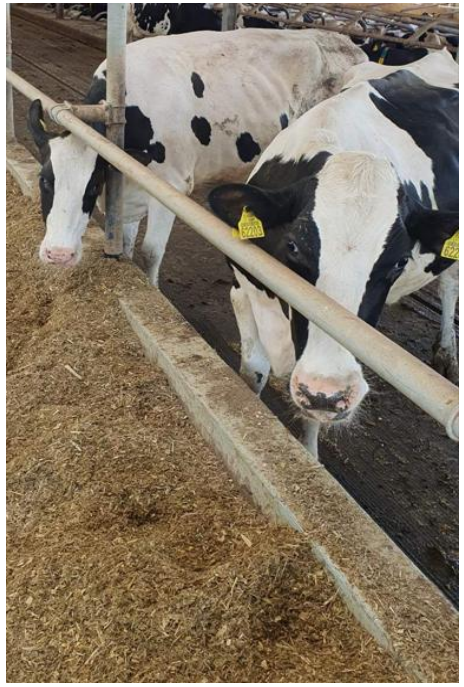
Sven Dänicke et al. 2005 J Animal Physiology And Nutrition

DON reduce feed intake

Induces release of anorexia mediators

DON
↓
CCK
↓
Satiety
↓
Feed Intake

DON induces the release of the satiety hormones, including cholecystokinin (CCK), which are critical mediators of anorexia



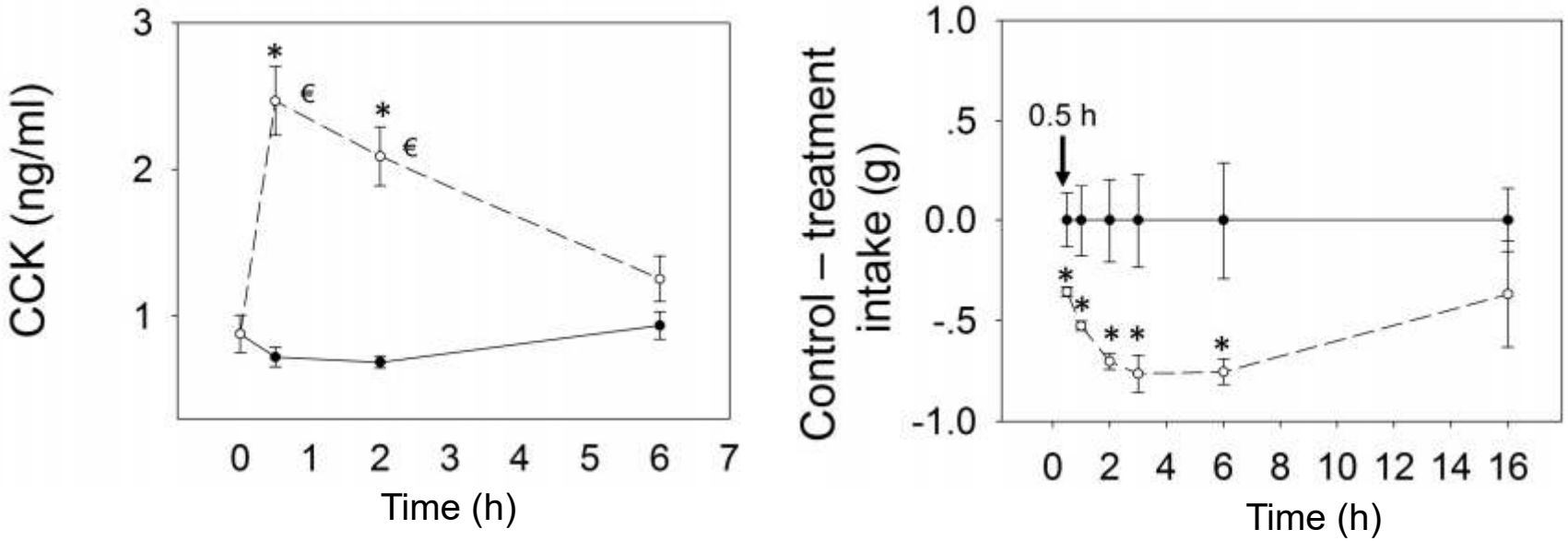


Figure. Relationship of DON exposure (--------) and a control diet (———) to the anorectic response (decrease in feed intake) mediated by CCK.

Wu et al., 2014; Toxicological Sciences

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Zearalenone: effect on rumen

Short term exposure of zearalenone shows negative effect on rumen fermentation, - microbiota, and health parameters in ruminants

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Zur Visitenkarte

Zebeli, Qendrim, Univ.-Prof. Dr.sc.agr.
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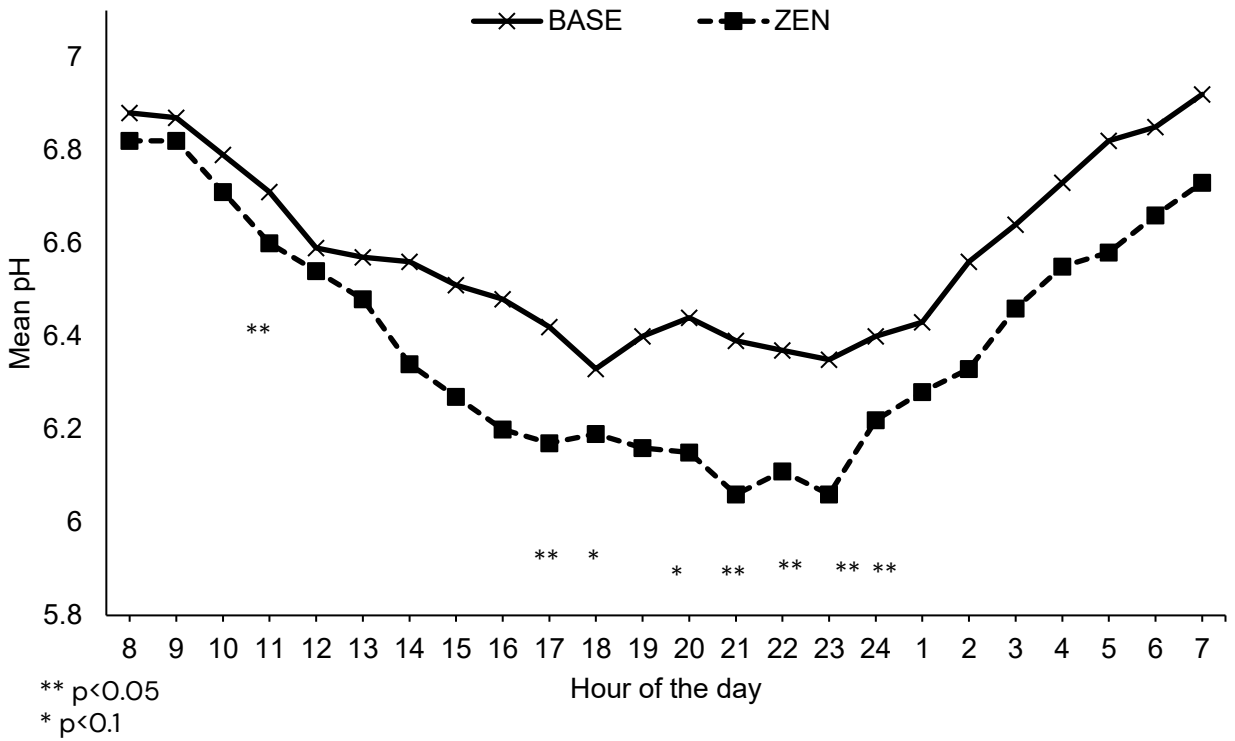
Zur Visitenkarte

pH

- ZEN reduces average and minimum pH (~0,5)



Hartinger et al. Toxins **2023,** 15, 185. https://doi.org/10.3390/toxins15030185

Mycotoxins challenge rumen bacterial population

Less rumen bacteria = lower digestibility & ruminal microbial protein synthesis

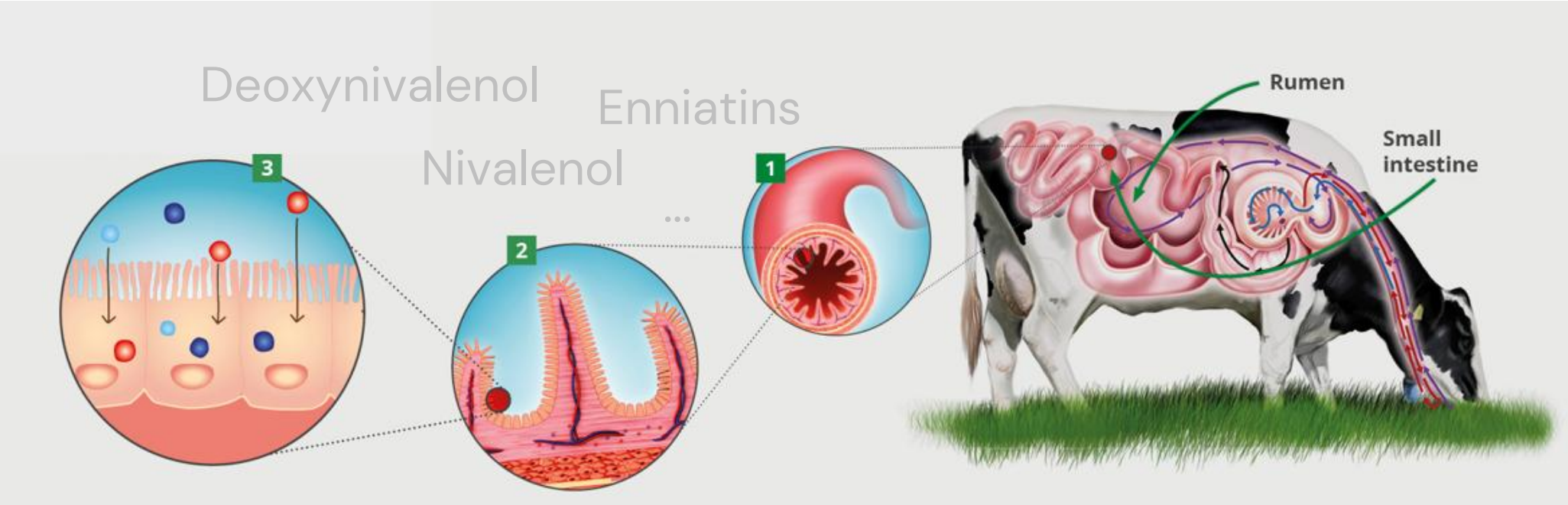
	Negative Control **	MPL 15	MPL 30
Rumen microbes-bacteria [x10^{12} cell/ml]	7.0^{a}	13.9^{b}	15.4^{b}
Total viable bacteria [x10^{9} CFU/ml]	4.9^{a}	7.0^{b}	8.7^{c}
Amylolytic [x10^{6} CFU/ml]	2.3^{a}	4.5^{b}	5.3^{b}
Proteolytic [x10^{6} CFU/ml]	1.5^{a}	2.1^{b}	2.7b^{c}
Cellulolytic [x10^{9} CFU/ml]	2.4^{a}	3.7^{a}	7.4^{b}

Kiyothong 2012 Animal Production Science

**AFB1 38 ppb; ZEN 541ppb; DON 720 ppb; FB1 701 ppb; T-2 270 ppb; OTA 74 ppb

http://dx.doi.org/10.1071/AN11205

Effect on Cattle

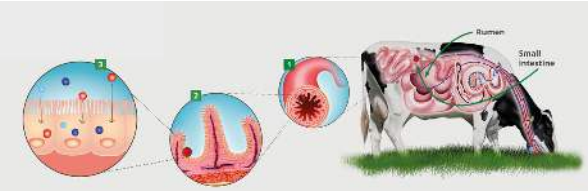


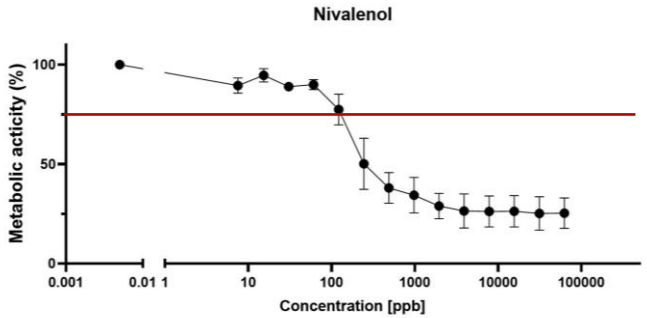
Mycotoxins reach the intestines!

- Δ Gut Microbiota
- ↓ Mucus-Production
- Damage Gut Barrier

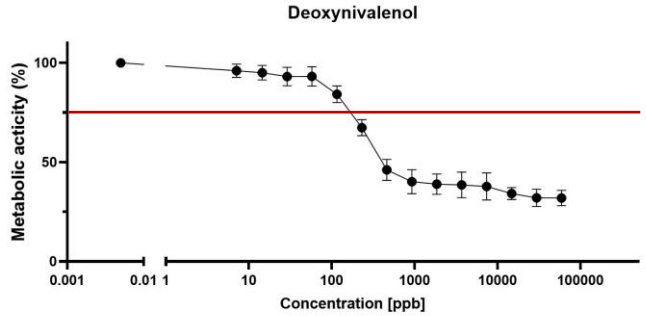
Digestion & Nutrient Absorption ↓
Immune Suppression ↑

Effect on Cattle

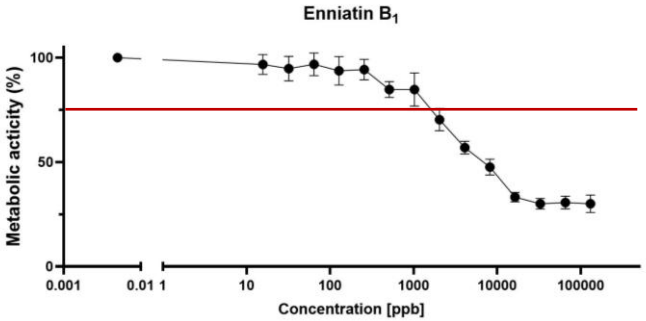




138 ppb



172 ppb



1500 ppb

toxins

MDPI

Article

Mycotoxin Occurrence in Maize Silage—A Neglected Risk for Bovine Gut Health?

Nicole Reisinger [1], Sonja Schürer-Waldheim [1], Elisabeth Mayer [1], Sandra Debevere [2,3], Gunther Antonissen [2,4], Michael Sulyok [5] and Veronika Nagl [1,*]

Toxins **2019,** 11(10),577. doi: 10.3390/toxins11100577

- Metabolic activity indicates the percentage of cells* that survive under a certain exposure of toxin
- The toxin concentration with 25% inhibition → indicates compromised intestinal function
- Toxicity: **NIV**>DON>ENN B

*Calf Intestinal Epithelial Bovine cell line

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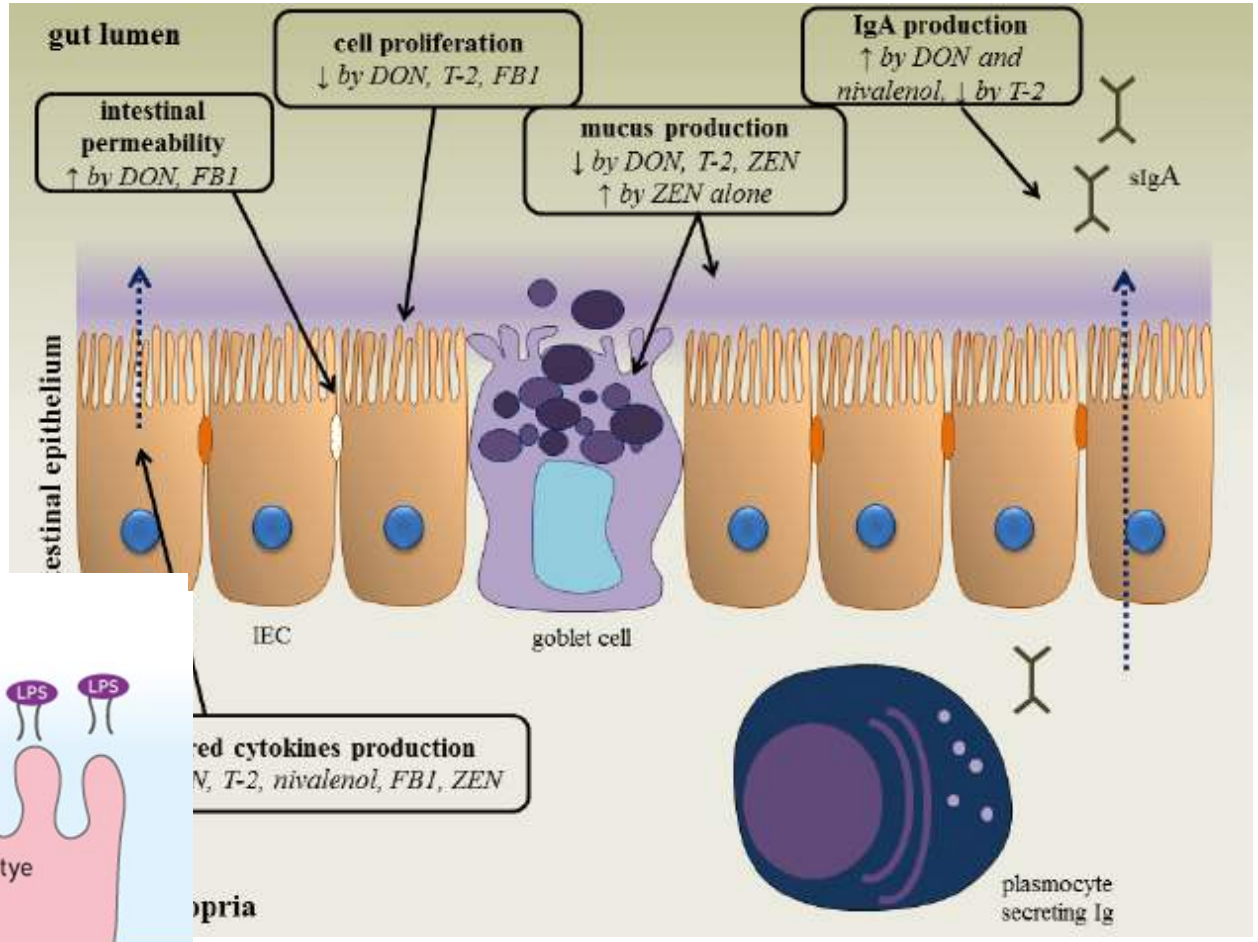
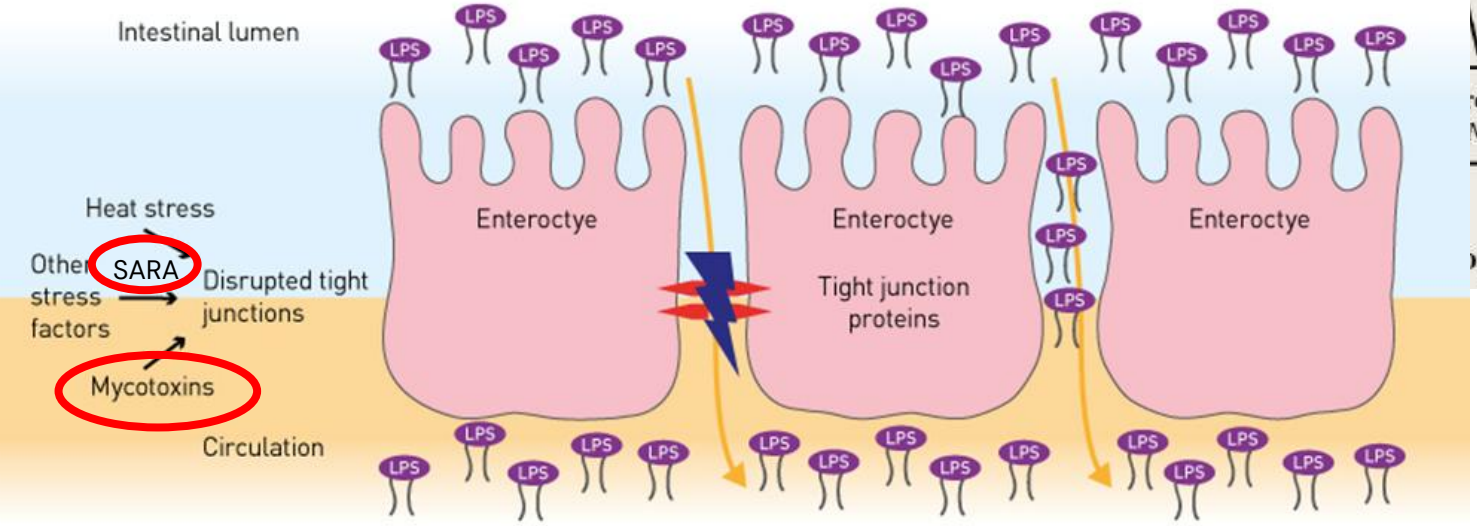
Effects of mycotoxins at intestinal level

GHENT UNIVERSITY

Antonissen et al Toxins **2014**, *6*



…interaction with endotoxins



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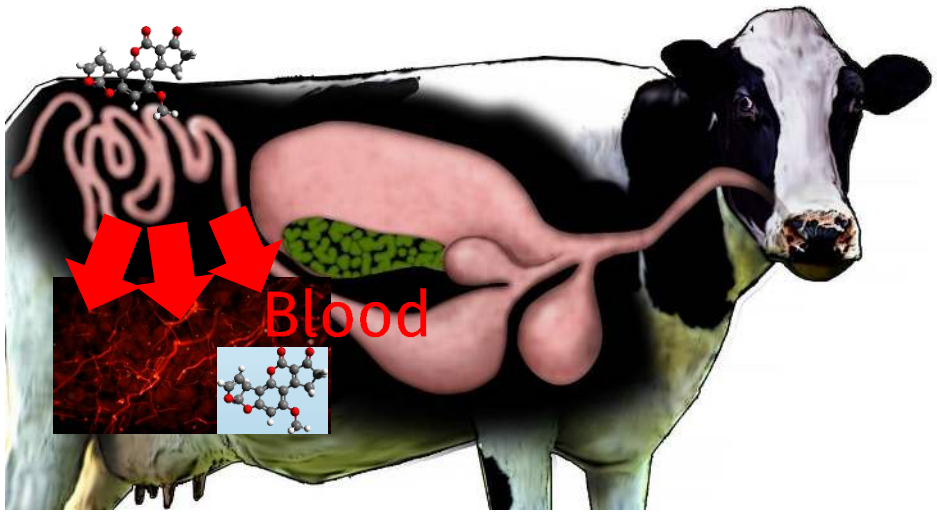
Effect on systemic cells



toxins

MDPI

Article

Bovine Peripheral Blood Mononuclear Cells Are More Sensitive to Deoxynivalenol Than Those Derived from Poultry and Swine

Barbara Novak [1], Eleni Vatzia [2], Alexandra Springler [1], Alix Pierron [2], Wilhelm Gerner [2], Nicole Reisinger [1], Sabine Hessenberger [1], Gerd Schatzmayr [1] and Elisabeth Mayer [1,*]

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2 Institute of Immunology, Department of Pathobiology, University of Veterinary Medicine Vienna, 1210 Vienna, Austria; eleni.vatzia@vetmeduni.ac.at (E.V.); alix.pierron@vetmeduni.ac.at (A.P.); wilhelm.gerner@vetmeduni.ac.at (W.G.)

* Correspondence: e.mayer@biomin.net; Tel.: +43-2272-81166-13432

Received: 5 March 2018; Accepted: 7 April 2018; Published: 11 April 2018

check for updates

- DON interferes in protein synthesis (in ribosom complex) of fast dividing cells
- Impact on immune cells (lymfocytes, monocytes)
- Lymfocytes are sensitive for DON:

  Ruminants [62 ppb] > Poultry [124 ppb] > Swine [249 ppb]

- Unfavourable conditions (SARA, MTXs, ..) amplify *transfer* of DON into blood!

Mycotoxins challenge ruminant immune system

Reduced immunity, increase disease outbreak

Item	MDP 0	MDP 15	MDP 30
Red blood cells (·106 cells/mL)	7.0a	10.0b	10.0b
White blood cells (·103 cells/mL)	7.0a	12.1b	12.5b
Eosinophil (%)	2.9a	7.6b	7.7b
Lymphocyte (%)	54.1a	72.8b	73.4b
Monocyte (%)	3.4a	6.2b	6.3b
IgA (g/L)	0.16a	0.32b	0.36b

**AFB1 38 ppb; ZEN 541ppb; DON 720 ppb; FB1 701 ppb; T-2 270 ppb; OTA 74 ppb

http://dx.doi.org/10.1071/AN11205

Kiyothong 2012 Animal Production Science

DON disrupts immune function

Effects of feed naturally contaminated with Fusarium mycotoxins on metabolism and immune function of dairy cows, University of Guelph

J. Dairy Sci. 92:1585–1593
doi:10.3168/jds.2008-1267

Effects of feed naturally contaminated with *Fusarium* mycotoxins on metabolism and immunity of dairy cows

S. N. Korosteleva,* T. K. Smith,* and H. J. Boermans†
*Animal and Poultry Science Department, Ontario Agriculture College, and
†Department of Biomedical Sciences, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada N1G 2W1

Table 2. Mycotoxin content of feedstuffs and experimental diets (mg/kg)

Mycotoxin[1]	Corn	Wheat	Hay	Corn silage	Control TMR	Contaminated TMR
DON	7.5	2.4	—	0.31	0.5	3.5
15-acetyl-DON	0.9	—	—	—	—	—
ZEN	0.7	—	0.31	—	—	—

Effect of diets on neutrophil **phagocytotic activity** (%; overall means)

Group	Phagocytosis activity
Control	64.0
Contaminated	53.3*
SEM	2.7
Control vs. contaminated (*P*-value)	0.0261

[1]Least squares means.
*$P < 0.05$.

Significantly decrease in neutrophil phagocytosis activity in cows fed mycotoxin contaminated feed.

DON (trichothecenes) drives disbalance in immune responses!

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Mycofix® effects on liver health

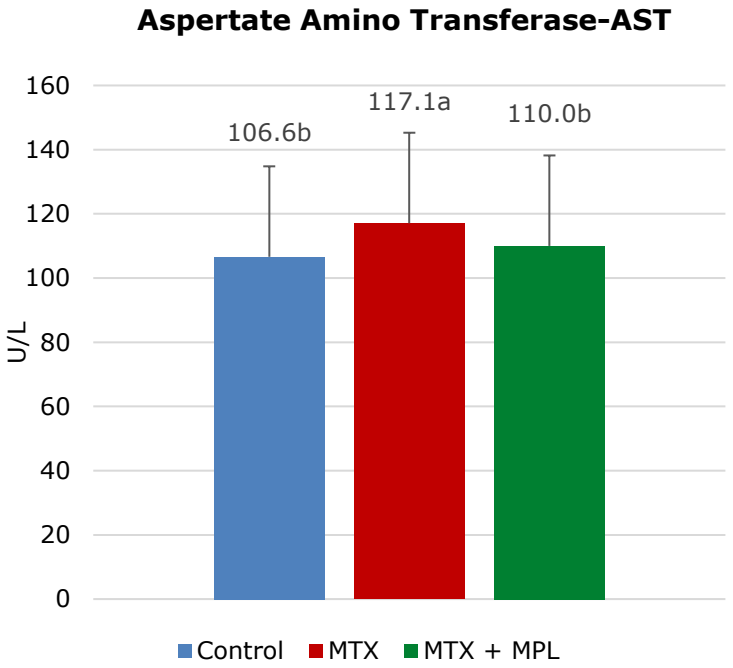
Journal of Dairy Science®
Official Journal of the American Dairy Science Association®

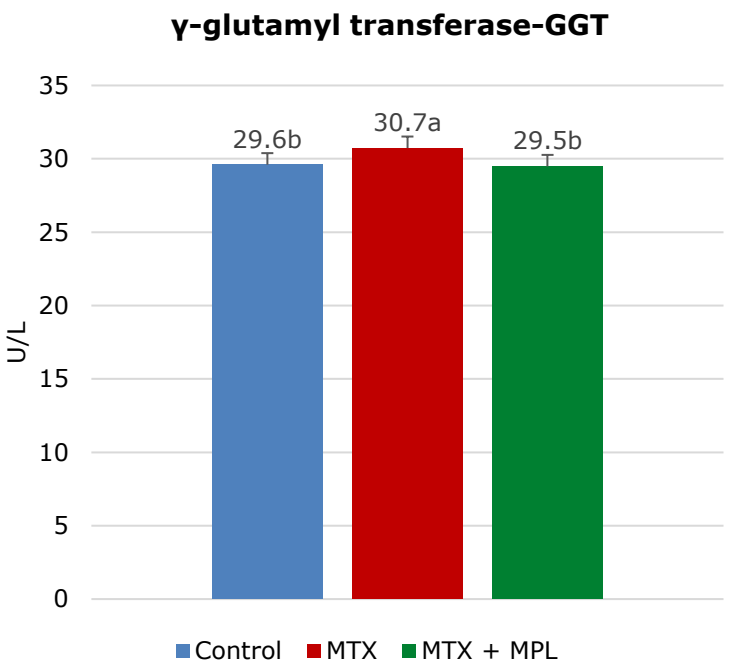
UNIVERSITÀ CATTOLICA del Sacro Cuore

A mycotoxin deactivating feed additive counteracts the adverse effects of low-level Fusarium mycotoxins in cows (Antonio Gallo *et al.*, 2020)

- Scientific Trial: 12 lactating Holstein Frisian cows
- Significant reduction **after 21 days** exposure to MTX

Treatments	DON (ppb)	FUM (ppb)	MPL (g/head /day)
Control	300	100	0
MTX	800	1100	0
MTX+MPL	800	1100	35





- Enzymes analysed in blood to indicate liver health conditions
- Significant increases in both indicators by MTX contamination (although low)

✓ Mitigated by Mycofix®

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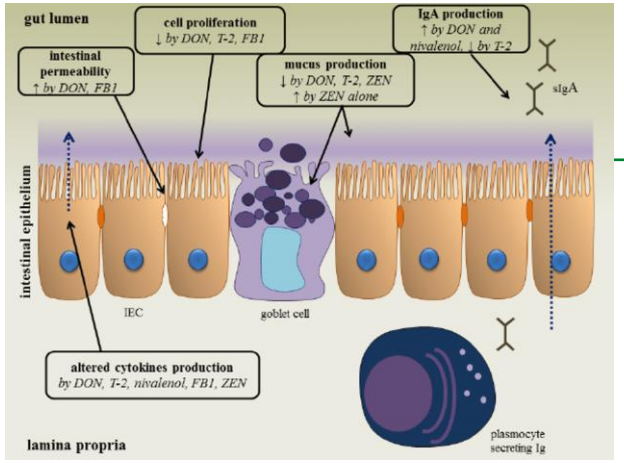
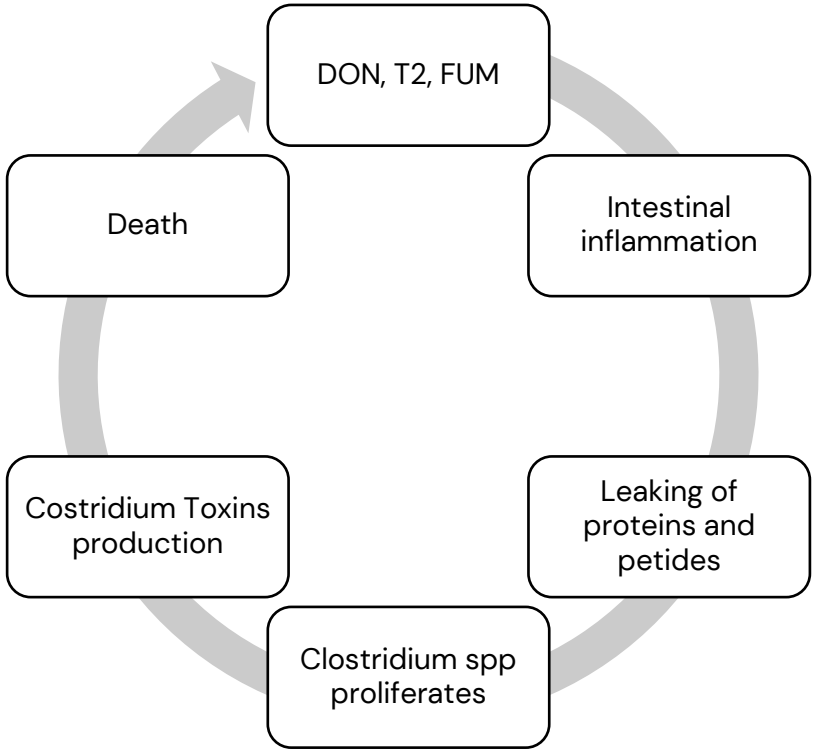
Clostridium spp. and Mycotoxins?





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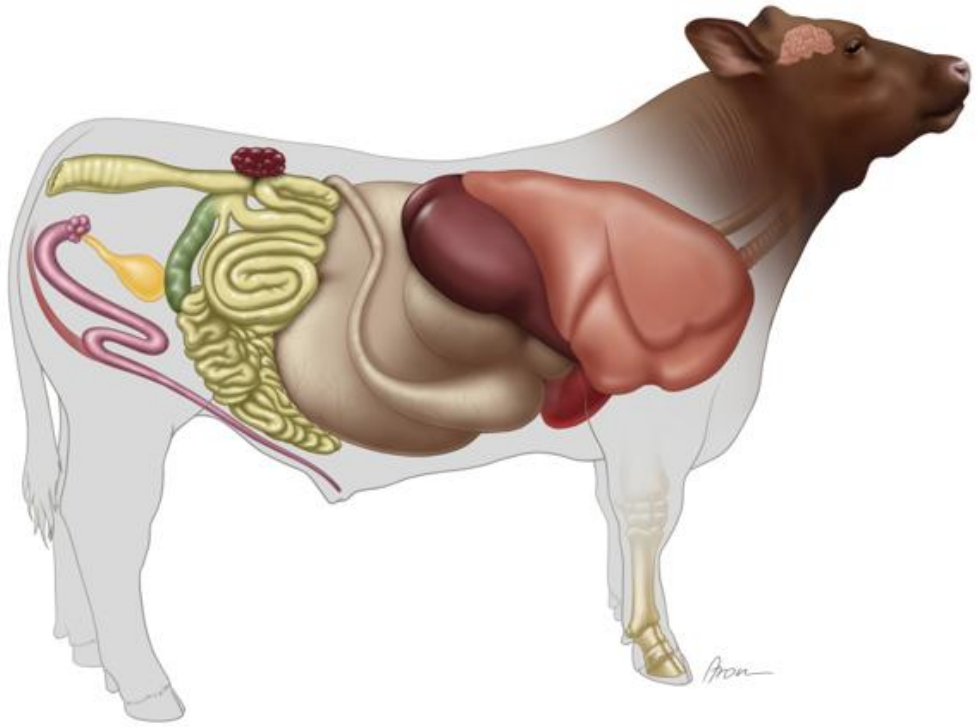
Mycotoxins, predisposing factor for gastrointestinal and systemic (infectious) diseases

(Antonissen et al. 2014, 2015; Bouhet and Oswald 2005; Gallo et al. 2015; Pinton and Oswald 2014)

- Diseases occurrence
- Treatment-related complications
- Vaccine failure (BRD)
- ….reduced productivity



Mycotoxin prevention, part of disease prevention program

Field Trials: mycotoxins impacting productivity & Health

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Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Supplementation of Mycofix on performance of feedlot cattle

W. Z. Yang[1], E.F. Schwandt[2], P.N. Gott[2], A.W. Levy[2], T.A. McAllister[1]

[1]AAFC, Lethbridge Research and Development Centre, Lethbridge, AB, Canada
[2]DSM Nutritional Products North America, Parsippany, NJ

July 16-20, 2023

Canada

Material and Methods

- 75 crossbred Angus steers (initial BW; 545 ± 42.4 kg)
- 3 treatments:
  - Control,
  - 10 g/head/d - (Biofix Select)
  - 15 g/head/d - (Biofix Select)
- 120 days on feed

Diet composition	%
Maize silage	8
Dry rolled maize grain	85
DDGS	4
Vitamin and mineral suppl.	3

ppb, DM basis

Date	DON	NIV	HT-2	Risk
6/8/22	424		136	med
7/7/22	268			low
8/11/22	386	358		med
9/1/22				low

Deoxynivalenol, DON; Nivalenol, NIV; HT-2, HT-2 Toxin

- Overall risk considered low to medium for feedlot cattle

Yang et al. 2023 (Animal Science Meeting)

Results – Performance

Item	Biofix Select, g/head/d			SEM	P value
	0	10	15		L
Number of steers	25	25	25		
Initial BW, kg	545	544	546	8.6	0.95
Final BW kg	764	762	778	10.7	0.42
ADG, kg/d	1.74	1.73	1.85	0.05	0.20
DM intake, kg/d	12.5	12.1	12.5	0.27	0.84
Gain:Feed, kg/kg	0.139	0.143	0.148	0.003	**0.05**

Numerical increase with (15 g/d)

+ 14 kg

+ 110 g/d

✓ **Significant 6.5% improvement in feed efficiency** (15 g/d)

Yang et al. 2023 (Animal Science Meeting)

Results – Health parameters and carcass characteristics

Item	Biofix select, g/head 0	10	15	SEM	P value L
Blood antioxidant					
Antioxidant, m*M*	0.282	0.251	0.204	0.026	**0.05**
SOD, U/mL	3.54	3.29	3.54	0.24	0.86
CAT, nmol/min/mL	14.1	14.0	17.0	1.44	0.22
Fecal					
pH	5.74	5.67	5.78	0.12	0.91
IgA, µg/g	15.0	22.7	30.1	5.54	**0.06**

↓Oxidative stress

↑50% [IgA]: Better immunity in the gut and possibly better absorption of nutrients

Item	Biofix select, g/head/d 0	10	15	SEM	P value L
Carcass characteristics					
Hot carcass weight, kg	448	448	459	5.8	0.21
Dressing percentage, %	61.1	61.2	61.5	0.24	0.31
Back fat, mm	22.6	23.7	23.2	2.71	0.96
LM area, cm^2	89.7	91.7	92.9	1.90	0.24
Marbling score[2]	562	609	551	22.2	0.99

+ 11 kg carcass (numeric, 15 g/d)

Yang et al. 2023 (Animal Science Meeting)

Evaluating the effects of Biofix® Select on the performance of finishing cattle Nebraska, USA; FT98 – Field trial

Materials and methods

- 249 Angus crossbred steers
- **Duration:** 171 days, starting from 403.65 kg
- **Contamination:**
  TMR (avg.): DON = 408 ppb; NIV = 494 ppb; ZEN = 98.5 ppb (***Medium risk*** for beef cattle)

Date	Ingred	Treatment	DON (ppb)	NIV (ppb)	ZEN (ppb)	Risk level
5/21/21	HMC	-		169.3		Low
5/12/21	TMR	Combined		906.5		Med-High
6/28/21	TMR	Mycofix	244.2	470.8		Medium
6/28/21	TMR	CON		516.6		Medium
10/18/21	TMR	Mycofix	605.1	807.2	98.5	High
10/18/21	TMR	CON	376.4	260.1		Medium

Treatments:

1. Control
2. Mycofix Select (15 g/d)

Results

	Control	MSE	Δ
Start Weight (kg)	398.7	408.2	
Final Weight (kg)	707.4	721.8	**+14.4kg**
Carcass weight gain (kg)	308.7	313.7	**+5kg**
ADG (g)	1,701	1,800	**+100g**
Mortality (%)	2,4	0,8	**-67%**
Feed conversion	6.52	6.25	**-4.1%**

Evaluating the effects of supplementing Mycofix® Select in Feedlot Cattle

Stellenbosch University, South Africa

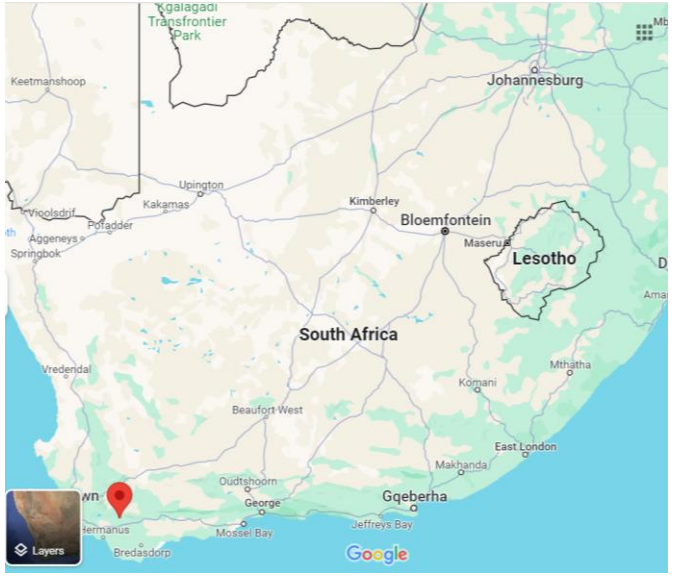
Trial Design

Cross-bred calves (n = 124 h; initial = 220 kg)

Duration: 120 d

Treatments:

- Control (n = 62)
- Mycofix Select (n = 62; 15 g/h/d)

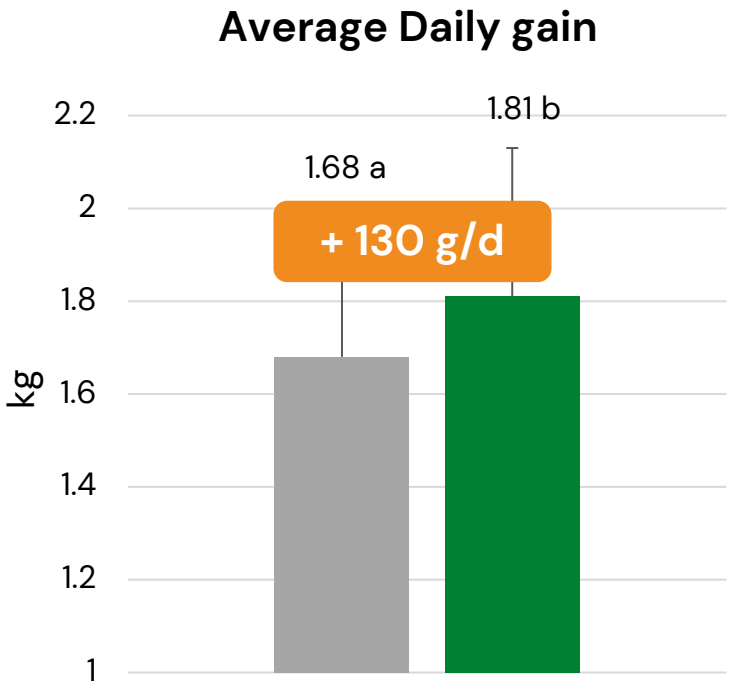


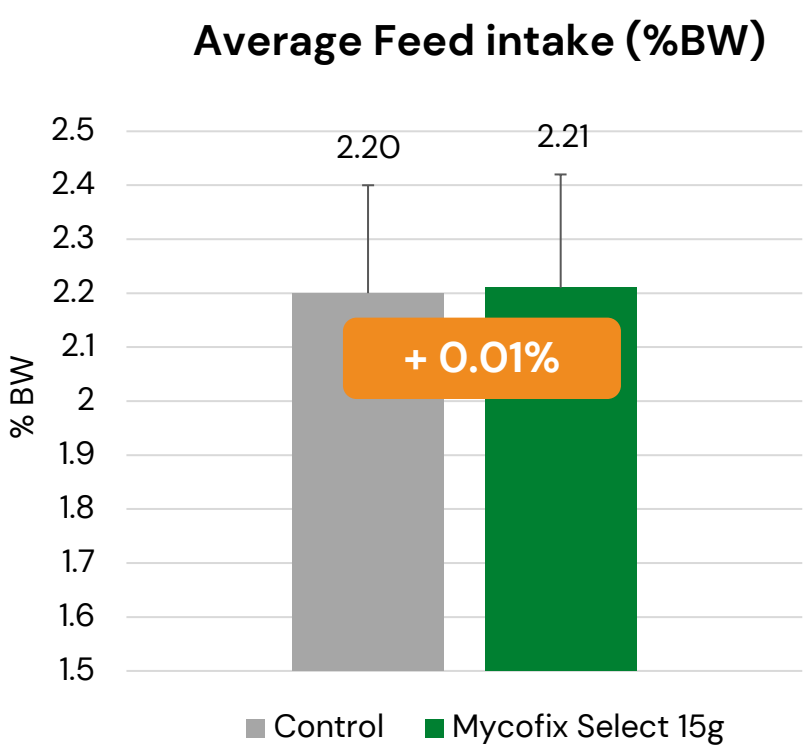
Contamination:

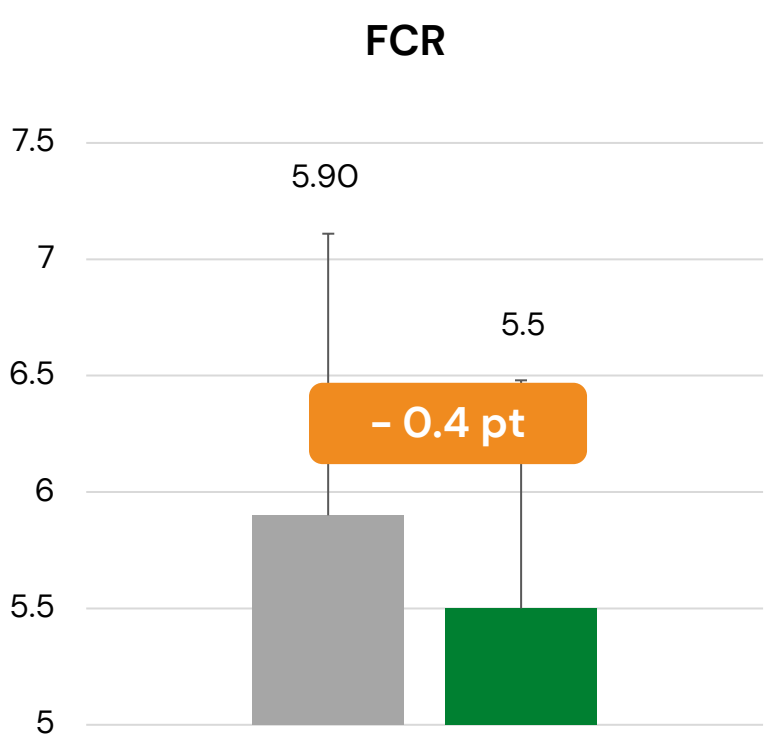
TMR (avg.): DON = 487 ppb and ZEN = 16 ppb

Medium risk mycotoxin challenge for beef cattle

Results – Performance







Mycofix Select treatment improved average daily weight gain and FCR

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Feeding Mycofix Improves Liver Health and Performance by Feedlot Cattle Fed a High-Concentrate Diet

Contents lists available at ScienceDirect

Animal Feed Science and Technology

journal homepage: www.elsevier.com/locate/anifeedsci

Feeding a clay mineral-based feed additive improves performance, eating behavior and liver health by feedlot beef cattle fed a high-concentrate diet

D.I.C.G. Gouvêa [a,*,1], M.B. Niehues [a,2], V.V. Carvalho [b,3], A. Perdigão [b,4], J. Faas [c,5], I. Artavia [c,6], M.C.S. Pereira [d,7], M.D.B. Arrigoni [a,8], C.L. Martins [a,9]

[a] São Paulo State University (UNESP), School of Veterinary Medicine and Animal Science, Botucatu, SP 18618-000, Brazil
[b] dsm-firmenich, Innovation and Applied Science Department, São Paulo, SP 03178-200, Brazil
[c] dsm-firmenich, Animal Nutrition and Health R&D Center, Tulln TU 3430, Austria
[d] São Paulo State University (UNESP), College of Technology and Agricultural Sciences, Dracena, SP 17900-000, Brazil

Objective: Evaluate the effects of liver health and performance of feedlot cattle supplemented Mycofix

Trial Design:

- 48 Nellore bulls (initial BW: 403 ± 5.1 kg)
- 95 days on feed
- Treatments:
  - Control
  - **Mycofix** 1.5 g/kg DM

Diets were considered ***low risk*** *for* mycotoxin contamination

dsm-firmenich Ruminants LATAM Innovation Center – MS - Brazil

Gouvea et al. 2025

Results– Performance

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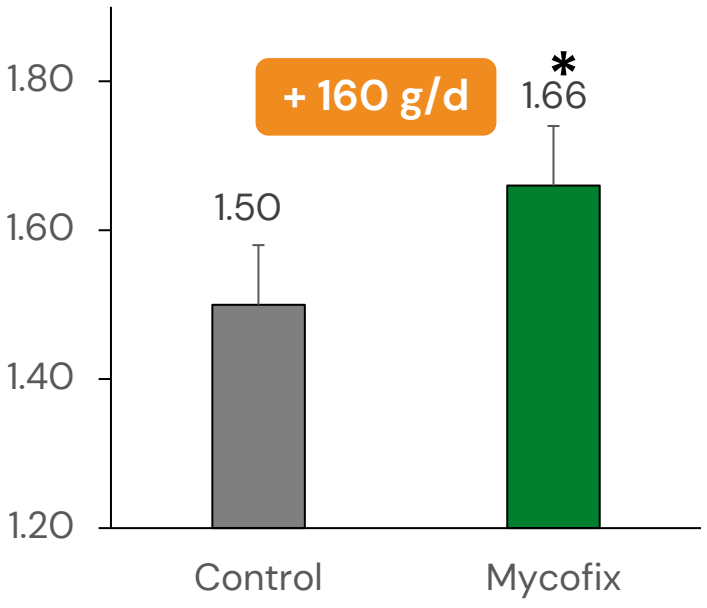
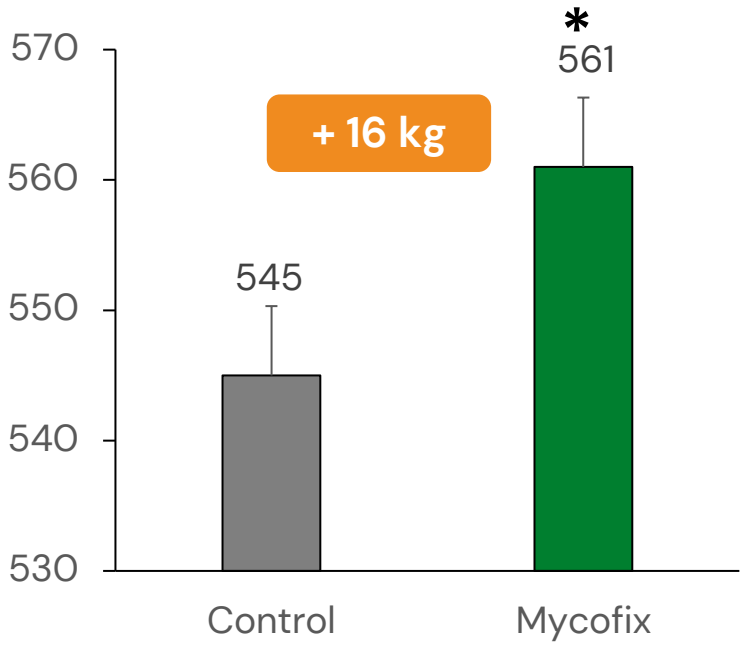
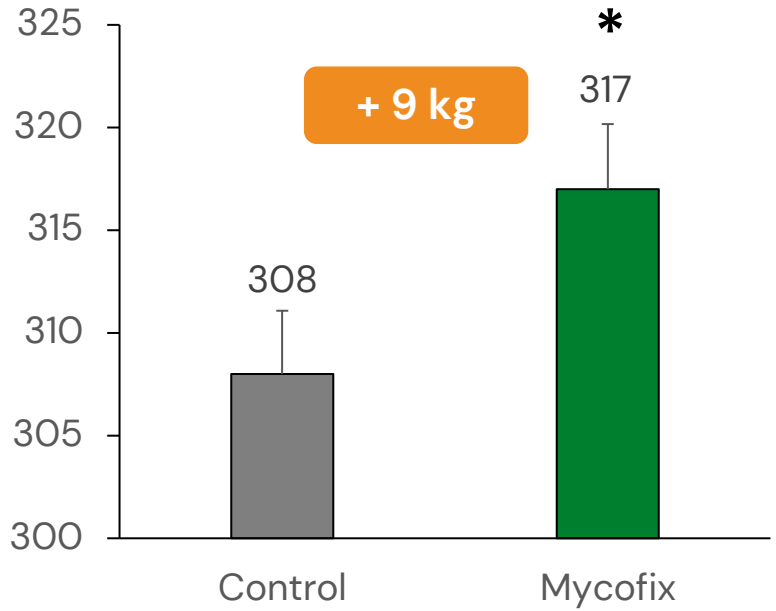
Average Daily gain, kg/d



Final Body Weight, kg/d



Hot Carcass Weight, kg



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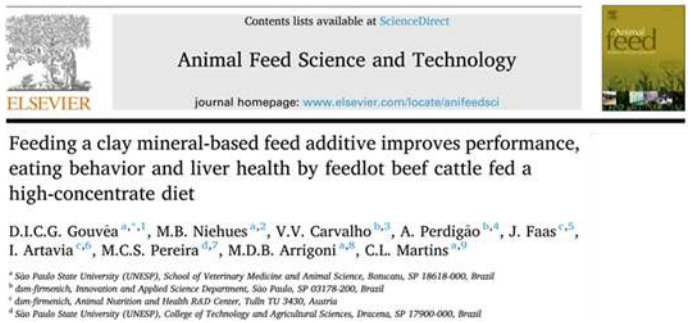
Results – Liver Health



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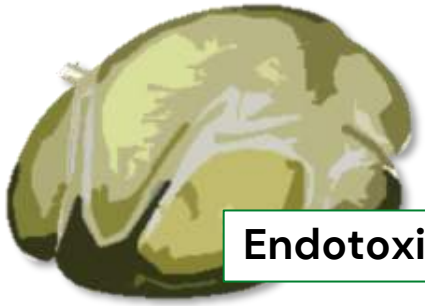
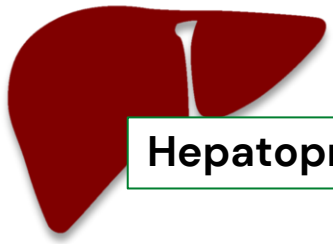
[d] São Paulo State University (UNESP), College of Technology and Agricultural Sciences, Dracena, SP 17900-000, Brazil



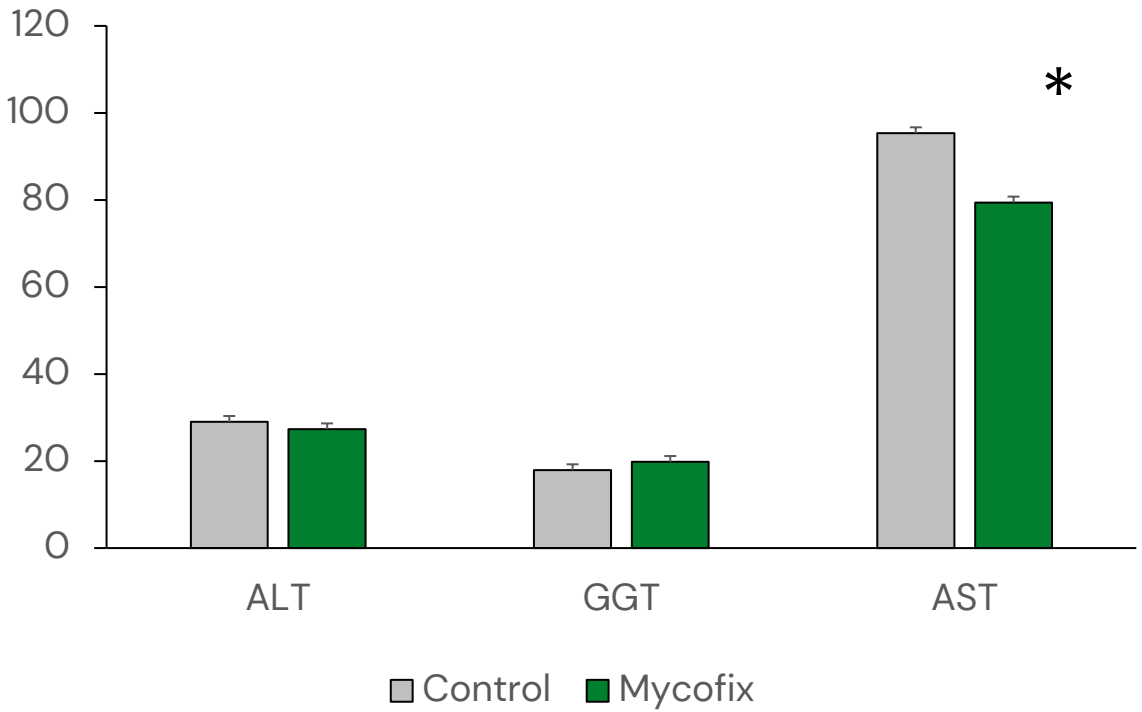
Endotoxin binding

Mycofix®



Hepatoprotection

Liver enzymes, U/L



Humer et al. 2019

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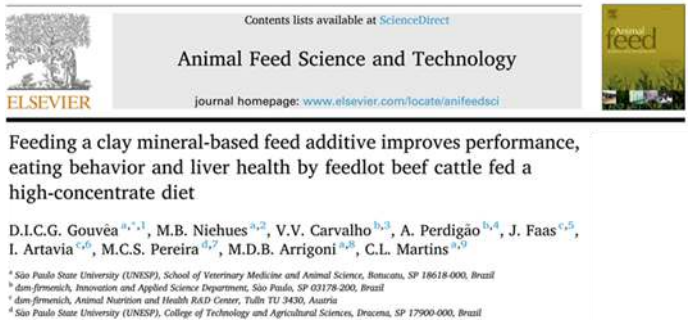
Results- Liver Histophathology


Contents lists available at ScienceDirect

Animal Feed Science and Technology

journal homepage: www.elsevier.com/locate/anifeedsci

Feeding a clay mineral-based feed additive improves performance, eating behavior and liver health by feedlot beef cattle fed a high-concentrate diet

D.I.C.G. Gouvêa [a,*,1], M.B. Niehues [a,2], V.V. Carvalho [b,3], A. Perdigão [b,4], J. Faas [c,5], I. Artavia [c,6], M.C.S. Pereira [d,7], M.D.B. Arrigoni [a,8], C.L. Martins [a,9]

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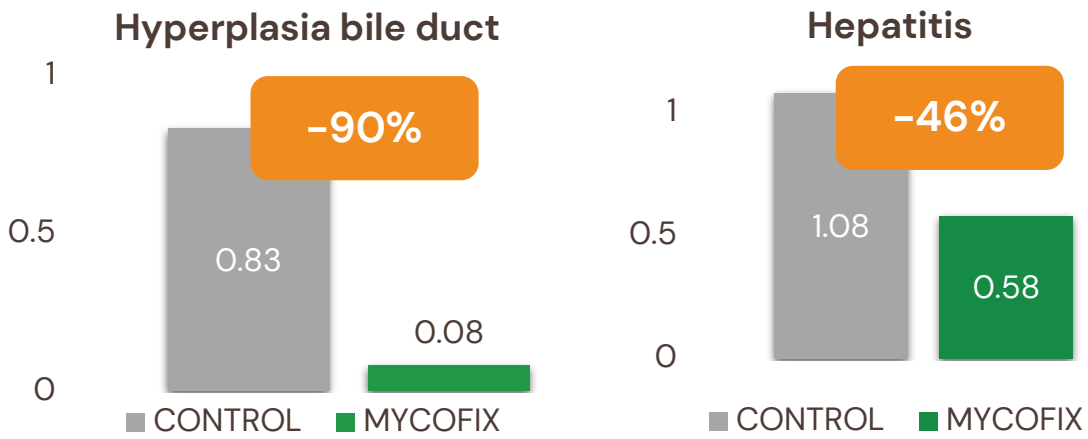
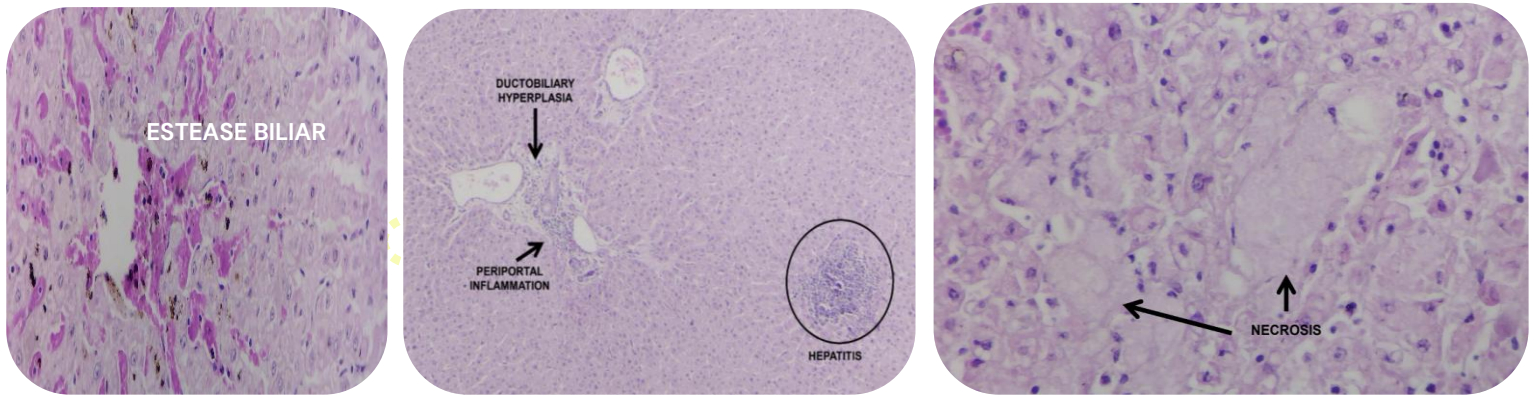


Effect of the additive to control mycotoxins on blood parameters, serum liver enzymes, incidence of liver abscesses and liver histology in feedlot cattle

	CONTROL	MYCOFIX	SEM	*P*-value
Inflammatory infiltrate	**1,08**	**0,75**	**0,115**	**0,05**
Portal inflammation	**1,00**	**0,75**	**0,099**	**0,09**
Fibrosis	0,67	0,33	0,197	0,26
Confluent necrosis	**0,25**	**0,00**	**0,046**	**0,07**
Focal necrosis	**0,58**	**0,00**	**0,081**	**0,01**
Steatosis/Vacuolation	1,58	1,42	0,195	0,55
Bile stasis	**0,33**	**0,00**	**0,050**	**0,03**
Cirrhosis	**0,25**	**0,00**	**0,046**	**0,07**
Total incidences of injuries	**8,42**	**4,25**	**0,687**	**<0,01**

P < 0.05

-50%



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Effects on Cattle

ZEN, Ergots
- Irregular heats
- Low conception rates
- Ovarian cysts
- Embryonic Loss
- Abortions
- Low testicular development
- Low sperm production

T-2, DON, AFB_1
- Gastroenteritis
- Intestinal hemorrhages
- Impaired rumen function
- Diarrhea
- Ketosis

Ergots
- Impaired thermoregulation
- Convulsions

T-2, DON, Ergots
- Decreased feed intake
- Decreased feed efficiency

DON, Ergots, Endotoxins
- Laminitis (lameness)

AFB_1, T-2, DON
- Milk contamination
- Decreased milk production
- Mastitis

DON – Deoxynivalenol
ZEN – Zearalenone
AFB_1 – Aflatoxin B_1
T-2 – T-2 Toxin
Ergots - Ergot Alkaloids
Endotoxins

ZEN: Zearalenon

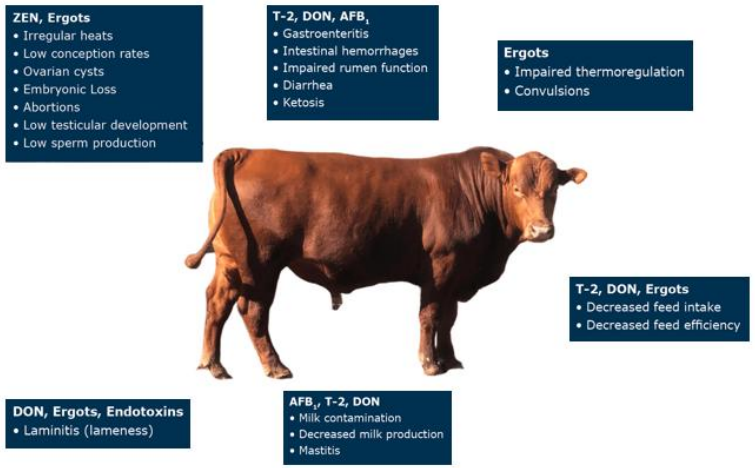
2 Effects on Cattle

VACCIN EFFICACY

ECONOMICAL LOSSES

HEALTH / IMMUNE SYSTEEM

- Impaired rumen function
- Gastroenteritis
- Intestinal hemorrhages
- Diarrhea
- Bacterial infections
- Liver, lung, rumen health
- Laminitis
- Mortality



PRODUCTION

- VLEESAANZET
- FW, HCW

FEEDINTAKE / -EFFICIENCY

-DMI
-FCR
-FE

PROCESSING EFFICIENCY

-Condemnations
-Variability in carcass weights

2 Effects on Cattle

Differential Diagnosis for Mycotoxicosis in Ruminants

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Mycotoxin Risk Management & Mycofix®

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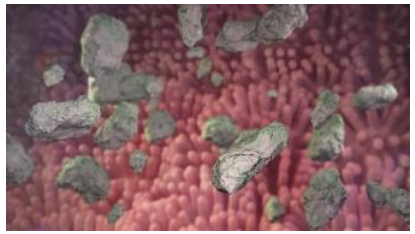
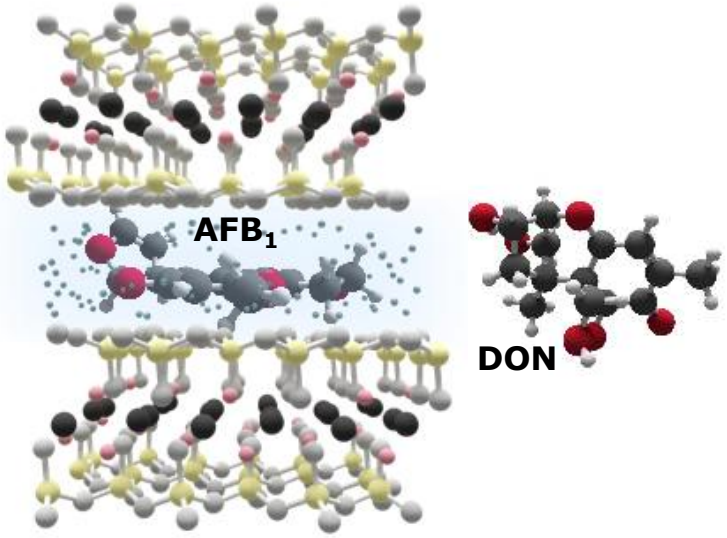
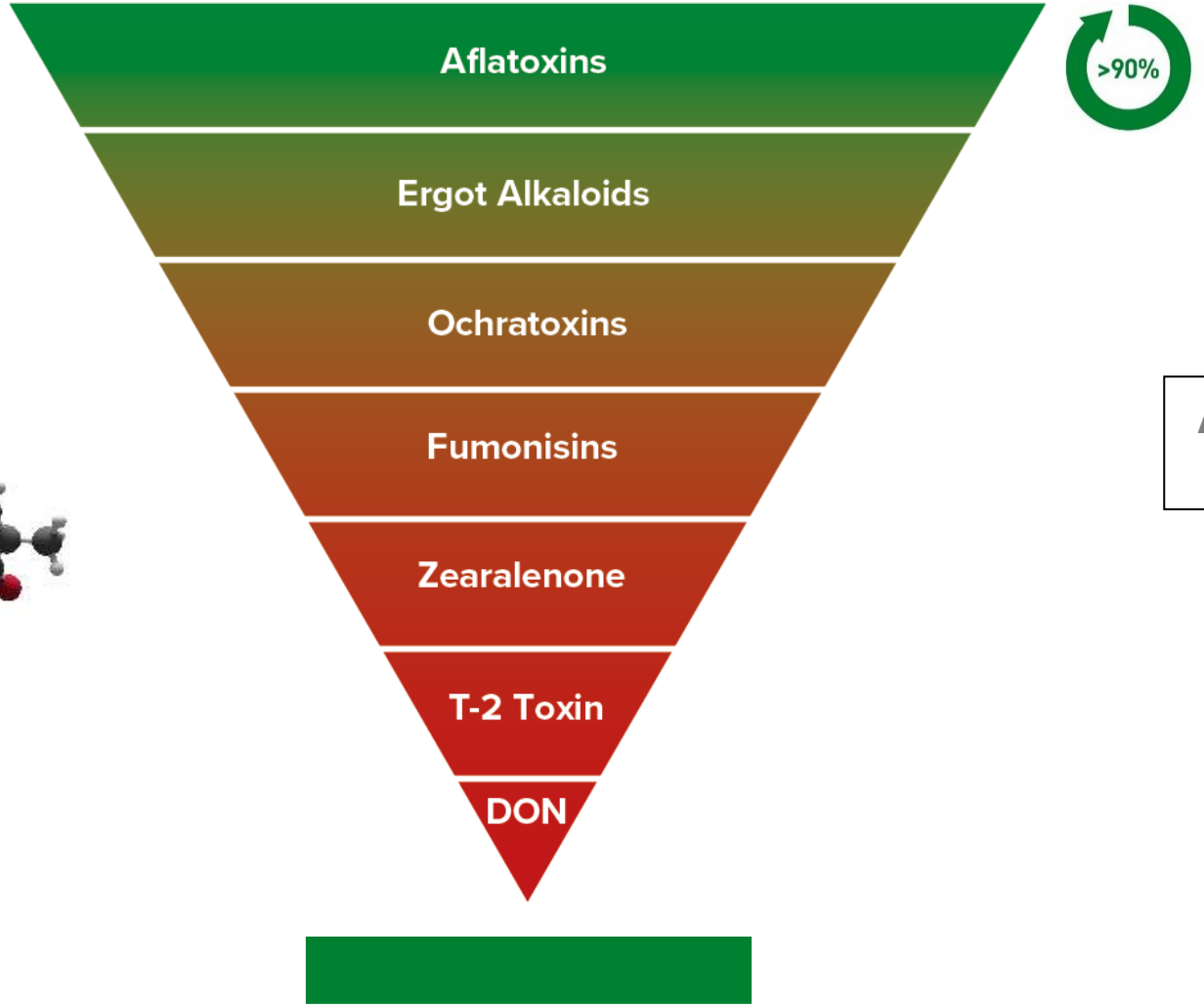
Adsorption (elimination of toxins)



EU authorized bentonite enables the elimination of the toxin by adsorption

COMMISSION IMPLEMENTING REGULATION (EU) No 1060/2013
of 29 October 2013
concerning the authorisation of bentonite as a feed additive for all animal species





1 polarity
2 functional groups
3 planarity

Adsorption efficacy

Hahn *et al.* 2015; Vekiru *et al.* 2014; EU Regulation 1060/2013; Frühauf *et al.* 2012; Vekiru *et al.* 2010; Deng *et al.* 2010; Friend *et al.* 1984; Kubena *et al.* 1990, 1991, 1993; Bursian *et al.* 1992; Williams *et al.* 1994; Phillips *et al.* 1995; Ramos *et al.* 1996; Scott *et al.* 1998

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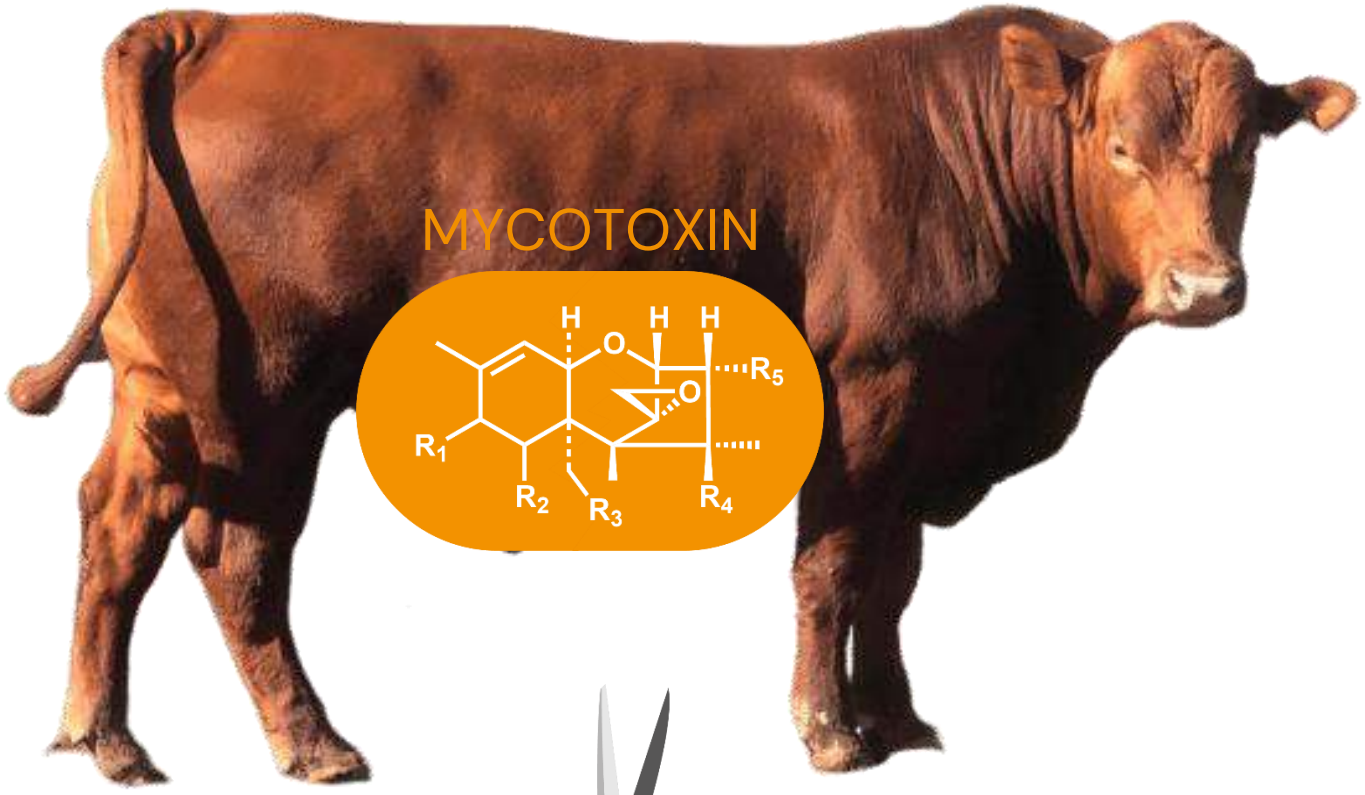
Enzymatic detoxification (“Biotransformation”) for non-adsorbable mycotoxins

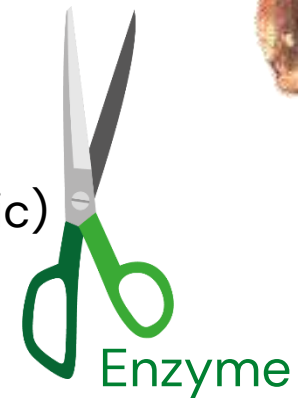
Non-toxic metabolite



Non-toxic metabolite

Should be:

- **Very specific** (specific toxin into known non-toxic)
- **Irreversible**
- **Safe**
- **Not interfering analytical MTXs method in feed**



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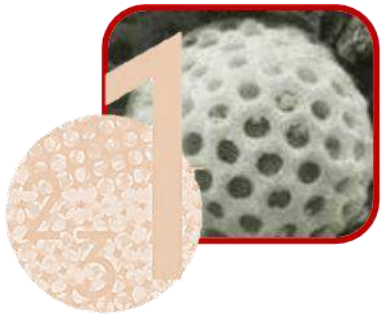
Mycofix® – Naturally ahead in mycotoxin risk management!



Adsorption

… for the elimination of toxins

Afla, Ergots, OTA, Endotoxins

Biotransformation

… for the elimination of toxicity

ZEN,FUM Trichothecenes

Bioprotection

… for the elimination of toxic effects

Liver protection and immune support

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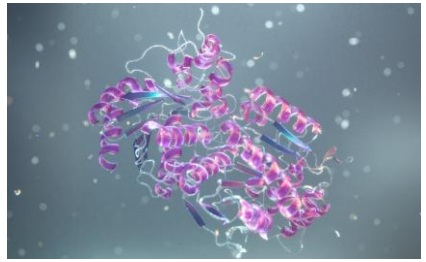
Mycofix® product line - The absolute protection against mycotoxins

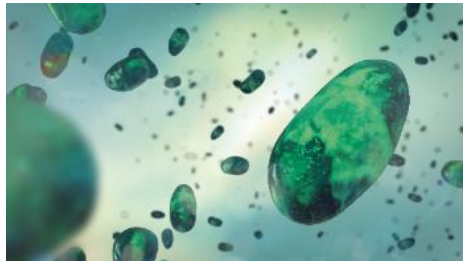
Biotransformation

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

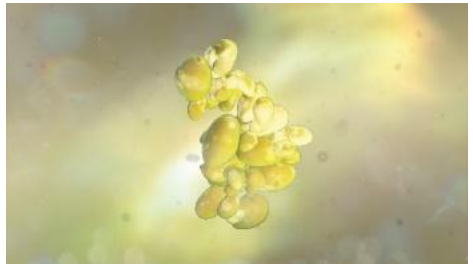


ZEN*zyme*® - purified enzyme degrades ZEN

FUM*zyme*® - purified enzyme degrades FUM

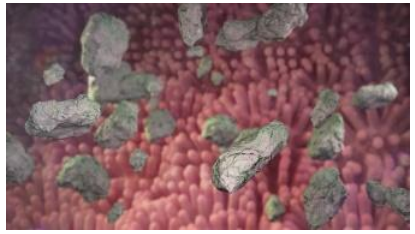


Biomin® BBSH® 797 DSM 11798 degrades trichothecenes



Biomin® MTV degrades OTA

Adsorption



Synergistic blend of minerals

Adsorbs Aflatoxins,
Ergot alkaloids and endotoxins

Bioprotection

Biomin® Bioprotection Mix

PATENTED

Supports the liver, immune system and intestinal integrity

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dsm-firmenich is the only company offering full coverage across all aspects of mycotoxin contamination prevention!

Mycofix®

1. **Adsorption** a synergistic blend of minerals

2. **Biotransformation**
   FUMzyme®

   Zenzyme®

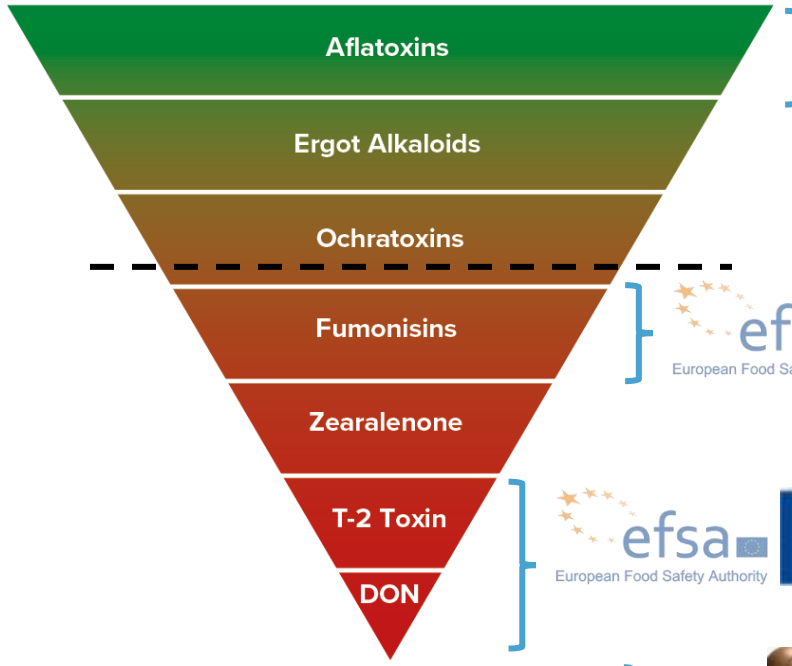
   Biomin® BBSH® 797

3. Biomin® **Bioprotection Mix** for immunity support, liver and gut health

4. **Mycotoxin analysis** of feed ingredients and finished feed

5. **Mycotoxin prediction** for contamination in upcoming harvests

Main Mycotoxins



efsa European Food Safety Authority

efsa European Food Safety Authority

FDA

CFIA

efsa European Food Safety Authority

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Scientific Publications

Biomin®

Some Peer Reviewed Literature on Mycofix

Summary of Peer Reviewed Literature

Aflatoxins:	**10** peer-reviewed papers
Zearalenone:	**5** peer-reviewed papers
Type A Trichothecenes (e.g. T-2):	**4** peer-reviewed papers
Type B Trichothecenes (e.g. DON):	**14** peer-reviewed papers
Ochratoxins:	**8** peer-reviewed papers
Fumonisins:	**6** peer-reviewed papers
Ergot alkaloids:	**2** peer-reviewed papers

Total Peer Reviewed Papers: **49**

Most recent Scientific Publications

OCHRA*zyme*

Toxins **2020**, 12(4), 258; https://doi.org/10.3390/toxins12040258
FEMS Microbiology Letters **2023**, Volume 370; https://doi.org/10.1093/femsle/fnad028
Journal of Animal Science **2023**, Volume 101; https://doi.org/10.1093/jas/skad171

ZEN*zyme*

Toxins **2019**, 11(8), 481; https://doi.org/10.3390/toxins11080481
Toxins **2020**, 12(6), 405; https://doi.org/10.3390/toxins12060405
Toxins **2020,** 12(11), 712; https://doi.org/10.3390/toxins12110712
Toxins **2021**, 13(2), 84; https://doi.org/10.3390/toxins13020084
Toxins **2023**, 15(1), 48; https://doi.org/10.3390/toxins15010048
Mycotoxin Research **2023**, Volume 39; https://doi.org/10.1007/s12550-023-00486-2
ACS Catalysis **2024**, Volume 14; https://doi.org/10.1021/acscatal.4c00271

FUM*zyme*

Poultry Science **2017**, Volume 96; https://doi.org/10.3382/ps/pex280
World Mycotoxin Journal **2018**, 11(2), 201; https://doi.org/10.3920/WMJ2017.2265
Toxins **2018**, 10(4), 150; https://doi.org/10.3390/toxins10040150
Toxins **2018**, 10(7), 296; https://doi.org/10.3390/toxins10070296
Toxicology Letters **2019**, Volume 305; https://doi.org/10.1016/j.toxlet.2019.01.013
Toxins **2019**, 11(9), 523; https://doi.org/10.3390/toxins11090523
Toxins **2020,** 12(11), 712; https://doi.org/10.3390/toxins12110712
Food Control **2021**, Volume 123; https://doi.org/10.1016/j.foodcont.2020.107726
Food Research International **2021**, Volume 145; https://doi.org/10.1016/j.foodres.2021.110395
Journal of Agricultural and Food Chemistry **2023**, 71(4); https://doi.org/10.1021/acs.jafc.2c08217
Journal of Agricultural and Food Chemistry **2023**, 71(36); https://doi.org/10.1021/acs.jafc.3c01733
Toxins **2024**, *16*(1), 3; https://doi.org/10.3390/toxins16010003

Take Home Message

Mycotoxins are highly prevalent in our feed

Check MTXs in Feed* !

High synergism among mycotoxins could lead to (sub)clinical processes

Put it in your Differential Diagnosis

EU (EFSA) guidance levels of mycotoxins in animal feed are getting lower

Use an approved Mycotoxin-deactivator

Effective mycotoxin risk management program should be the base for **PROTECT**ing **your beef herds!**

*Golden standard for MTXs (farm) risk assessment

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We bring progress to life

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