MYCOTOXIN MITIGATION

A New Approach

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TODAY'S SESSION

PURPOSE: Build your knowledge base and comfort level relative to the detrimental effects of mycotoxins and strategies to help cows overcome mycotoxin challenges and strengthen the gut.

PROCESS: We will explore peer-reviewed research that illustrates the role Refined Functional Carbohydrates™ (RFCs™) have in protecting the gut epithelial cells from mycotoxins to build resiliency.

PAYOFF: Elimination of marketplace confusion that will allow a better understanding of how mycotoxin mitigation options can be objectively evaluated and implemented. This process will aid in the identification of research-proven and field-tested opportunities to maximize herd profitability.

WHAT ARE MYCOTOXINS?

- Toxic secondary metabolites produced by fungi that have direct and indirect negative effects on livestock and poultry.
- Can be formed on crops in the field, during harvest, or during storage, processing, or feeding.
- Present in more than 85% of grains worldwide. The threat of mycotoxins also exists in silage.
- Additive effect of multiple mycotoxins in a diet is more acute than when present alone.

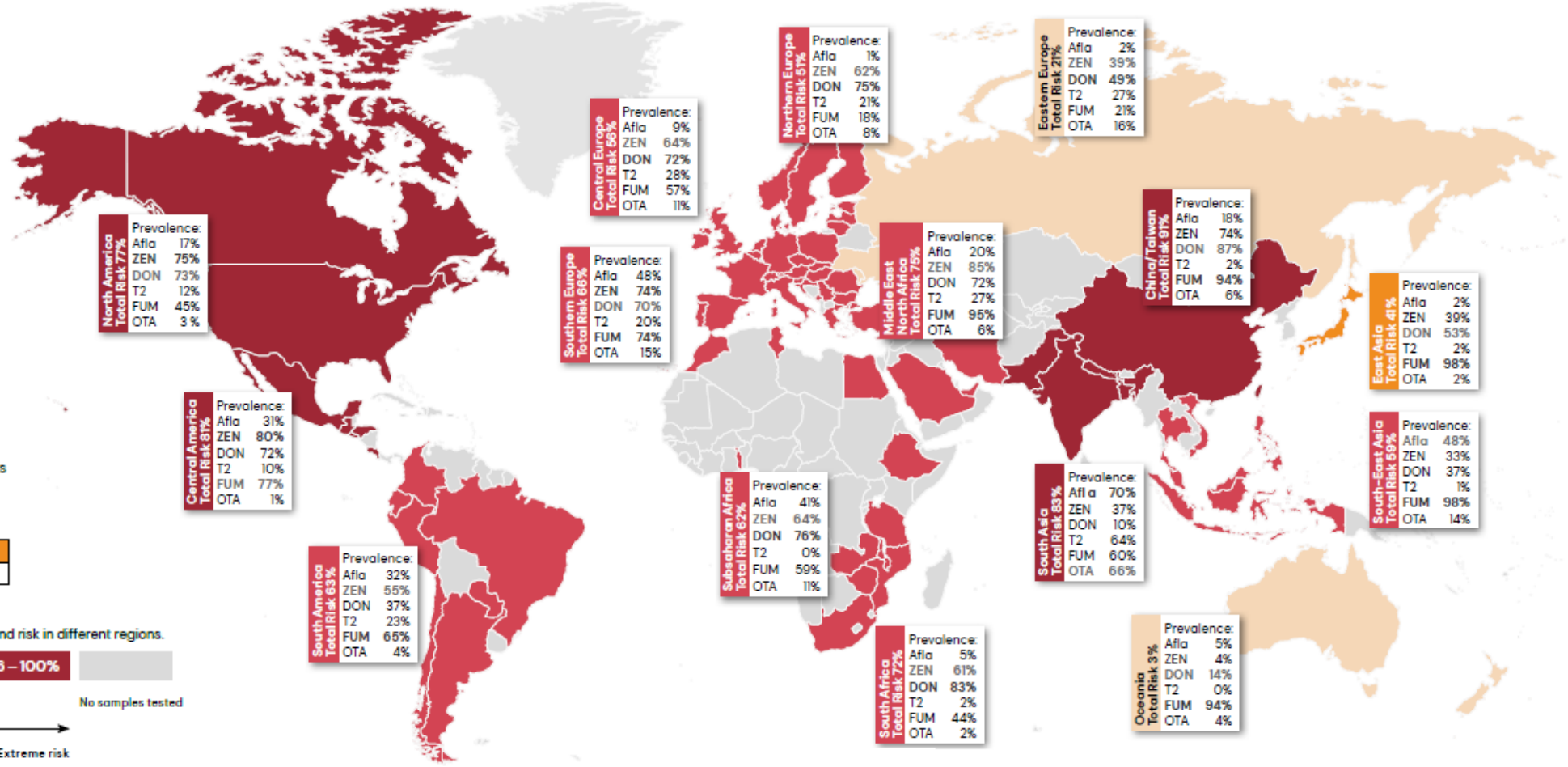
GLOBAL MYCOTOXIN SURVEY

January – June 2025

11 520
Samples

58 277
Analyses

77
Countries



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	T2	FUM	OTA
2	50	150	50	500	10

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

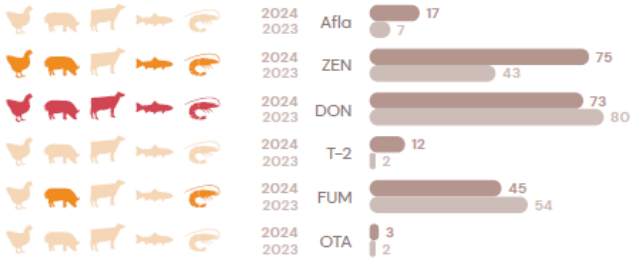
0 – 25% | 26 – 50% | 51 – 75% | 76 – 100% | No samples tested

of samples above risk threshold

Moderate risk ⟷ Extreme risk

Source: DSM

NORTH AMERICA

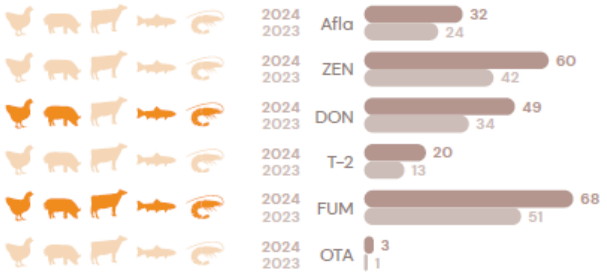


Animal colours indicate the risk posed to this species by the prevalence and concentration of each mycotoxin in all samples from this region (light orange=moderate to red=extreme see color code page 2)

% Contaminated samples January – June 2024 and January – June 2023

Total samples: 1135	Afla	ZEN	DON	T-2	FUM	OTA
Number of samples tested	1098	1108	1064	1064	1064	1061
% Contaminated samples	17%	75%	73%	12%	45%	3%
Average of positive (ppb)	42	149	1713	29	2990	5
Median of positive (ppb)	2	43	720	13	1139	3
Maximum (ppb)	1767	6513	32220	360	96316	62

LATIN AMERICA

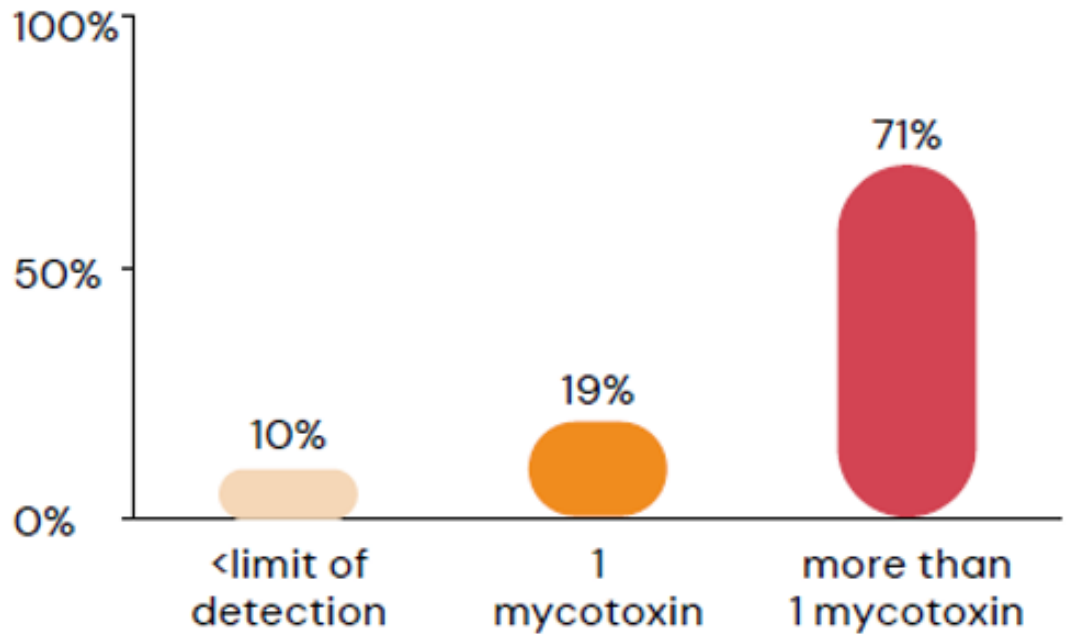


Animal colours indicate the risk posed to this species by the prevalence and concentration of each mycotoxin in all samples from this region (light orange=moderate to red=extreme see color code page 2)

% Contaminated samples January – June 2024 and January – June 2023

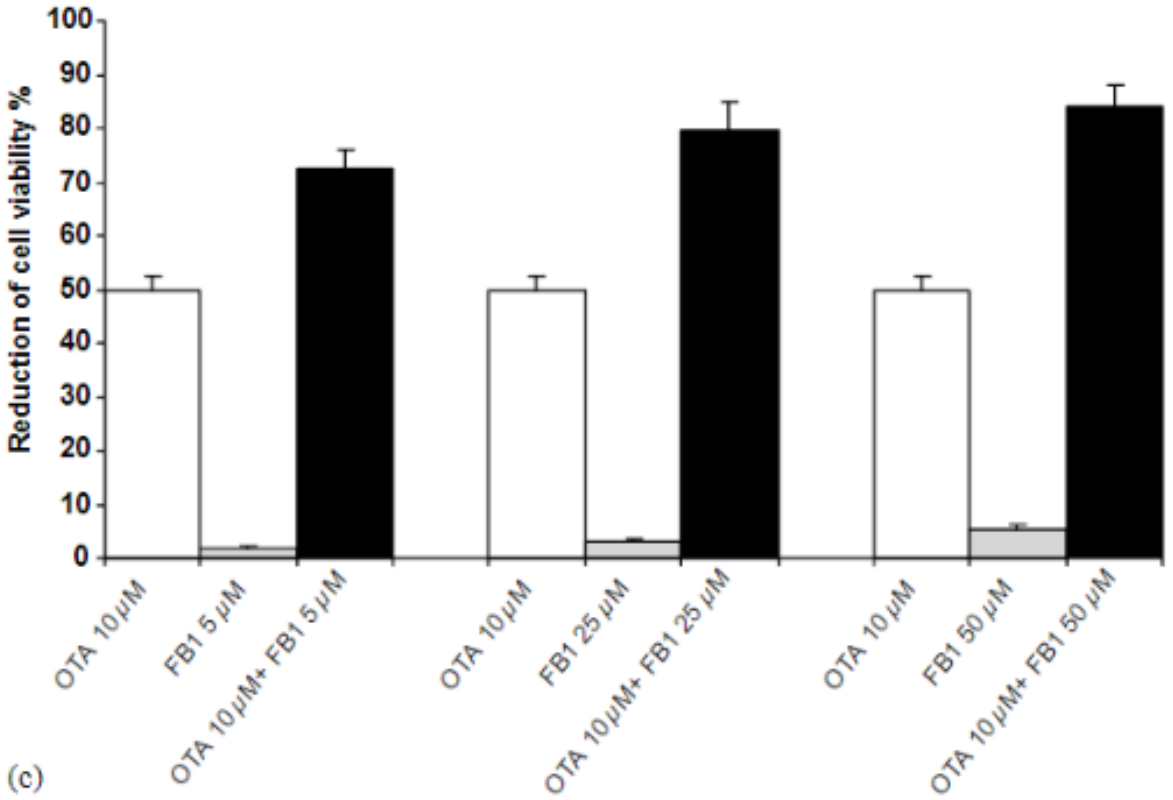
Total samples: 3 422	Afla	ZEN	DON	T-2	FUM	OTA
Number of samples tested	3300	3267	2177	2811	2501	2004
% Contaminated samples	32%	60%	49%	20%	68%	3%
Average of positive (ppb)	4	79	535	35	2496	3
Median of positive (ppb)	2	40	299	31	1463	2
Maximum (ppb)	306	2599	9856	200	244701	15

RISK OF CO-CONTAMINATION WITH MORE THAN ONE MYCOTOXIN



INTESTINAL DESTRUCTION (cytotoxicity)

is synergistic with presence of more than one mycotoxin



E.E. Creppy et al. / Toxicology 201 (2004) 115–123

PREDICTING MYCOTOXIN LOAD IN A RATION IS VERY DIFFICULT

Hence, even if there is no evidence of mycotoxins it is a good insurance policy to use mycotoxin mitigation strategies.

EFFECT OF MYCOTOXINS

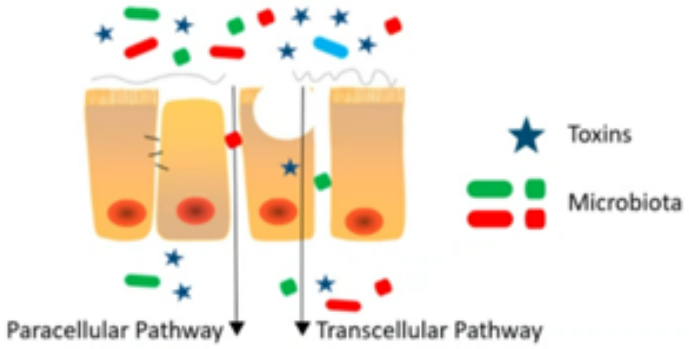
Mycotoxins Only

Aflatoxin Fumonisin **Zearalenone**
DON Ochratoxin Patulin T2

Oxidative Stress, ROS

Tissue Damage

Gut integrity is reduced,
and permeability is increased



• Toxins migrate to organs • Secondary infections
• Suppress immunity • Poor gut morphology
• Reduced performance

ARM & HAMMER'S APPROACH: PPR

PREVENT NEGATIVE EFFECTS.

Resist the detrimental impact of mycotoxins to help animals meet their production potential.

PROTECT AT THE CELLULAR LEVEL.

Get 'inside out' protection against gut cytotoxicity caused by a variety of mycotoxins.

BUILD RESILIENCE AHEAD OF CHALLENGES.

Prepare your animals for unseen challenges which may be hidden in their ration.

BG-MAX™

BG-MAX DEVELOPMENT

How are active RFCs identified?

FEEDINFO
PERSPECTIVES

Understanding Mycotoxin Cytotoxicity Key to Improving Mitigation Strategies, Says ARM & HAMMER

AUGUST 2021

Our understanding of the mycotoxin challenge has largely been informed by data captured through feedstuff testing and monitoring of the animal's health. The result has been mitigation strategies focused on reducing the occurrence and effects of mycotoxins in animals without a clear grasp of their actions on a cellular level. Until recently.

Cytotoxicity assays are now helping us understand the damaging actions that mycotoxins can have on an animal's intestinal cells and their degree of toxicity. This in vitro test uses special dyes which help show the stages of a cell's lifecycle. Healthy cells, with their cell membrane intact, will hold the dye well and show up fully coloured on scans. As cell-membrane damage occurs in the presence of a toxin, the cells will leak dye and appear progressively lightly coloured. Dead cells are completely colourless, having leaked all the dye. This gives researchers a means to see cell degradation and a scale by which to measure the toxicity of a substance.

For ARM & HAMMER Animal and Food Production cytotoxicity assays represent a new way for the industry to approach the mycotoxin challenge, going from preventative strategies to more protective ones. For more, we spoke to the company's Technical Services Manager, Dr Sangita Jalukar, and also discussed what cytotoxicity assays have revealed about the efficacy of ARM & HAMMER's BG-MAX™ mycotoxin solution.

[Feedinfo] What does this improved knowledge of mycotoxin activity on animal cell integrity gathered from cytotoxicity scans reveal about the efficacy of our current methods of control?

Dr Sangita Jalukar
Technical Services Manager
ARM & HAMMER Animal and Food Production

- Intensive research determined the RFC type and molecular size produced by our enzymatic hydrolysis process arising from a specific yeast strain produced by ARM & HAMMER.
- Activity of each RFC was identified and those appropriate for mycotoxin management selected and combined with a bentonite specifically processed to make animals resilient and maintain performance consistently.

PREVENT

What BG-MAX does?

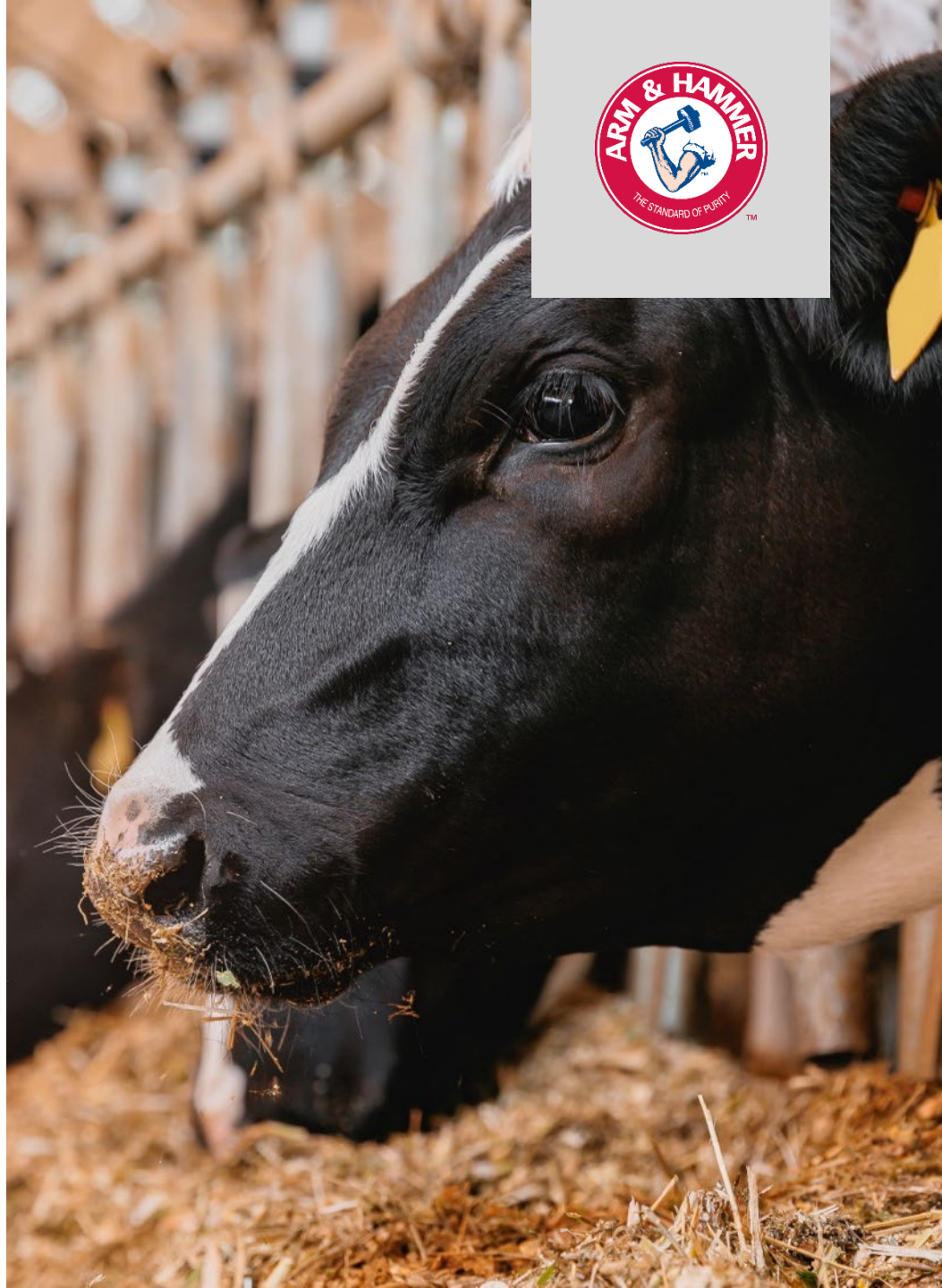
- Binds common mycotoxins present in feed stuff

What it means?

- PREVENT mycotoxins from causing any damage to the host by binding them

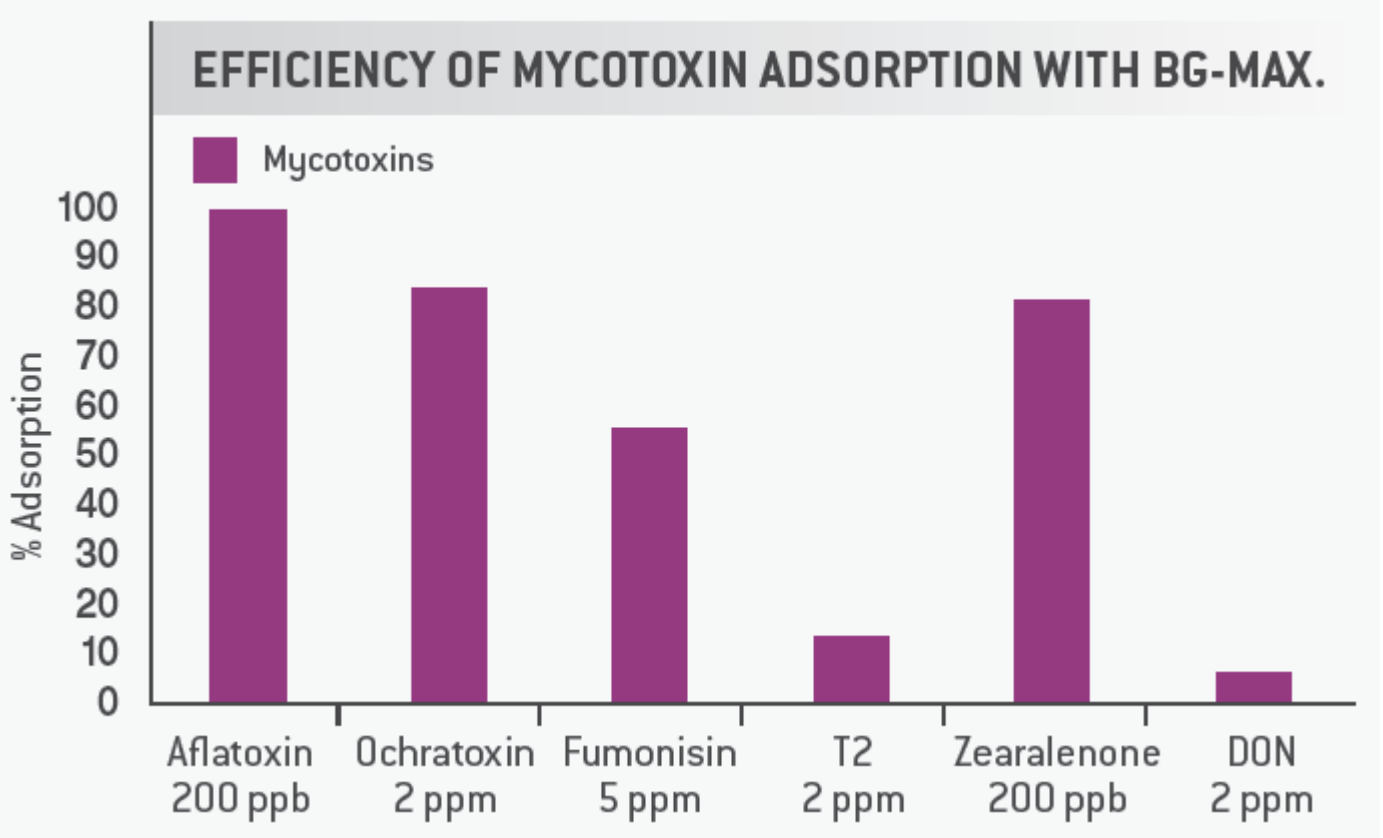
Drawback

- No mycotoxin binder can bind all mycotoxins



PREVENT

PREVENT mycotoxins from causing any damage to the host and being absorbed by binding them.



PROTECT

Any unbound mycotoxins pose a threat to the first line of defense (the gut)

What BG-MAX does?

- Works from the inside-out and PROTECTS the gut epithelial surface from mycotoxin damage

What it means?

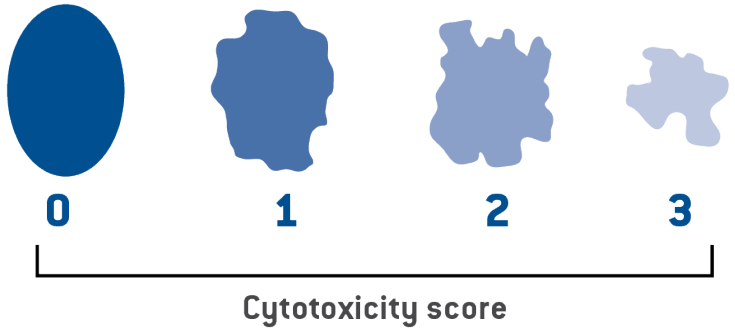
- It blocks the transfer of mycotoxins from the gut to the organs
- The protection is effective against multiple mycotoxins

BG-MAX advantage

- Unique cytotoxicity ability makes it the **only product** shown to protect the animal from the inside-out

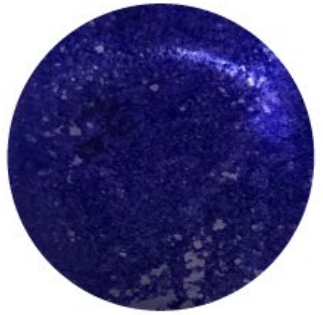
PROTECT

BG-MAX protects the gut epithelial cell from mycotoxin damage

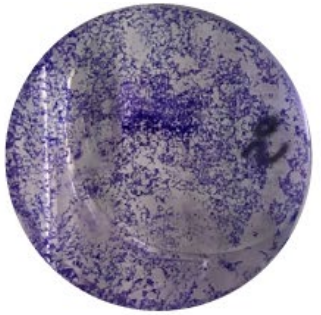


1. Toxin incubated with cell
2. After 4 hrs, cells washed with methanol solution
3. Stained with Trypan Blue dye

Cell control
(cytotoxicity score 0)



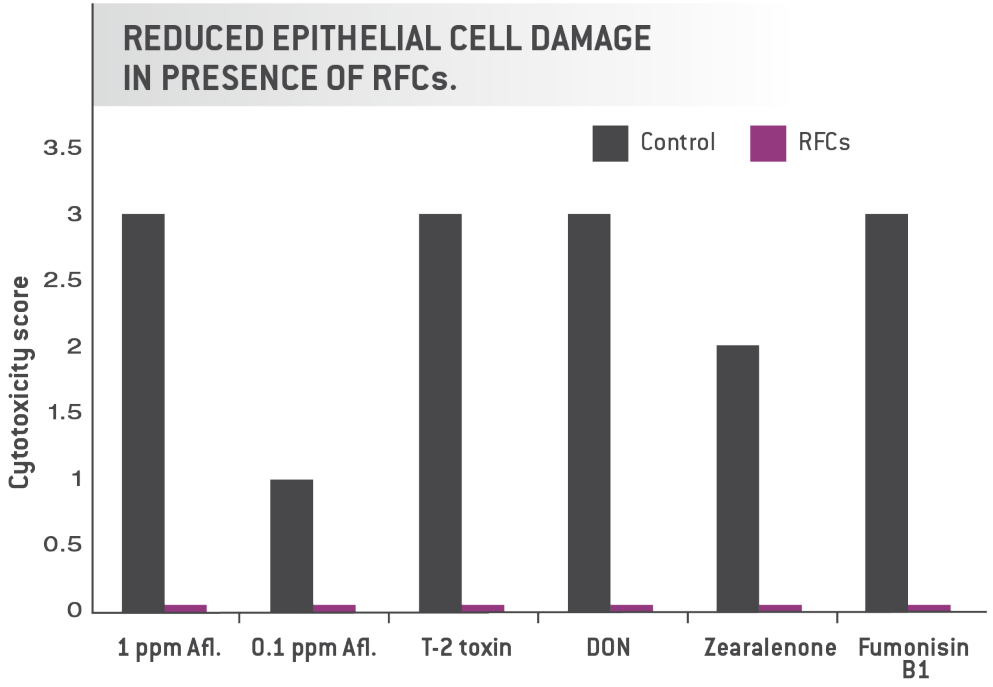
RFCs Fumonisin B1 100 ppm
(cytotoxicity score 1)



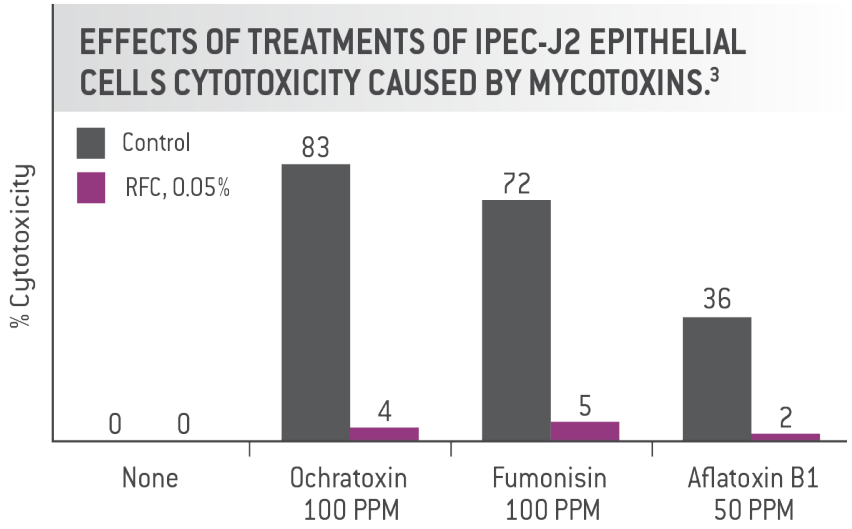
Fumonisin B1 100 ppm
(cytotoxicity score 3)

PROTECT

BG-MAX protects the gut epithelial cell from mycotoxin damage



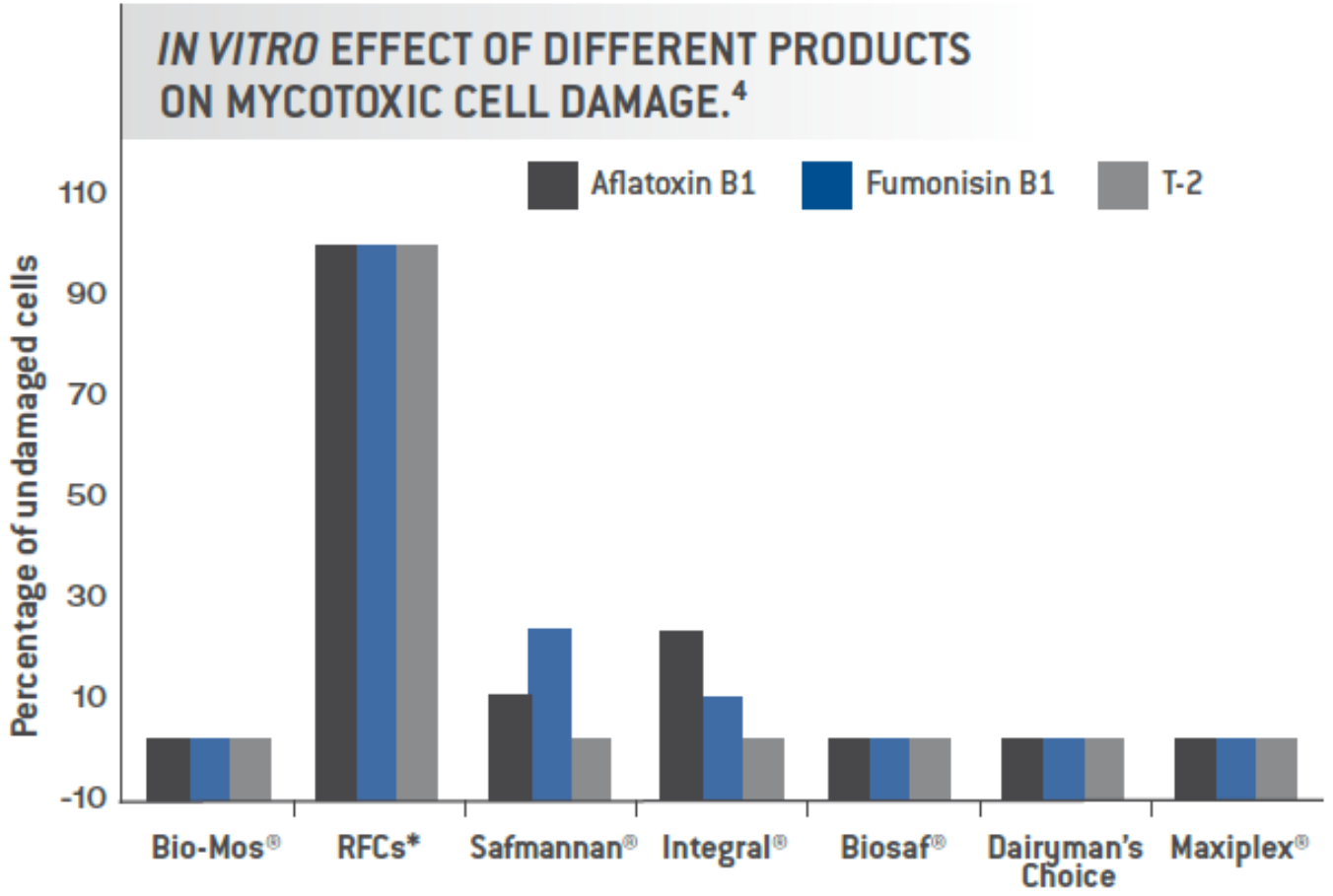
Baines et. Al. BMC Research Notes 2011, 4: 110



In vitro study, 2021

PROTECT

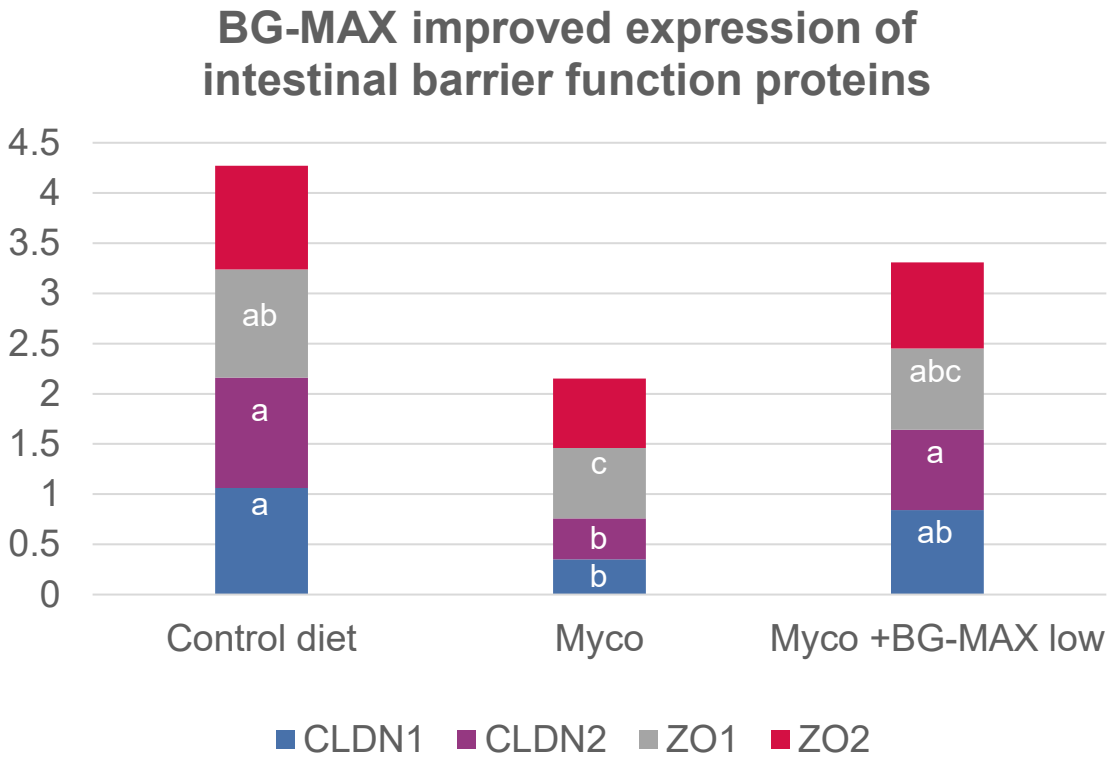
The Protect Effect is unique to RFCs



Baines *et al.*, 2013. Presented at the Gut Health Symposium in St. Louis.

PROTECT

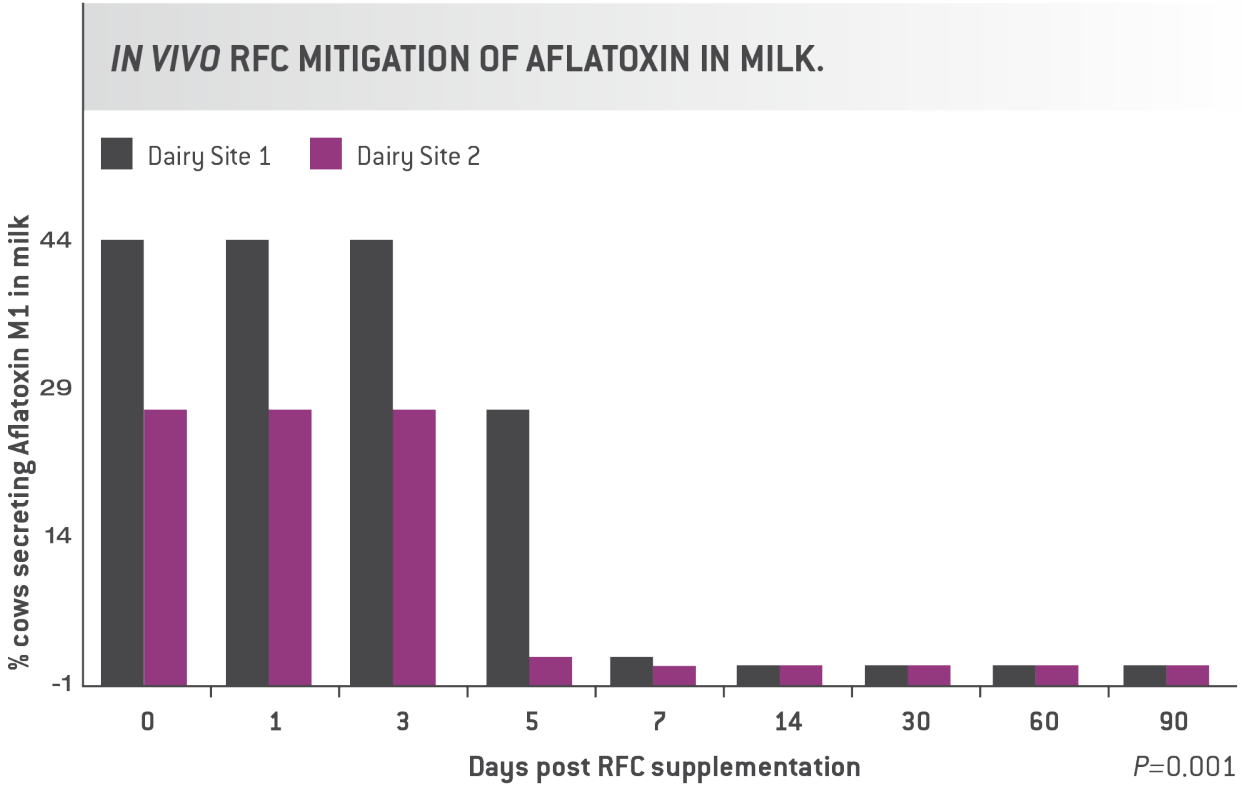
Effect of treatments on intestinal barrier function



- Intestinal barrier function proteins Claudin 1 (CLDN1), Claudin 2 (CLDN2), Zonaoccludin 1 (ZO1) and Zonaoccludin 2 (ZO2) play a key role in maintaining gut integrity and permeability
- Mixed mycotoxin challenge decreased gut barrier function
- Supplementation with BG-MAX partially restored it

PROTECT

RFCs protect gut - limits translocation of aflatoxin from gut into milk



RESILIENCE

What BG-MAX does?

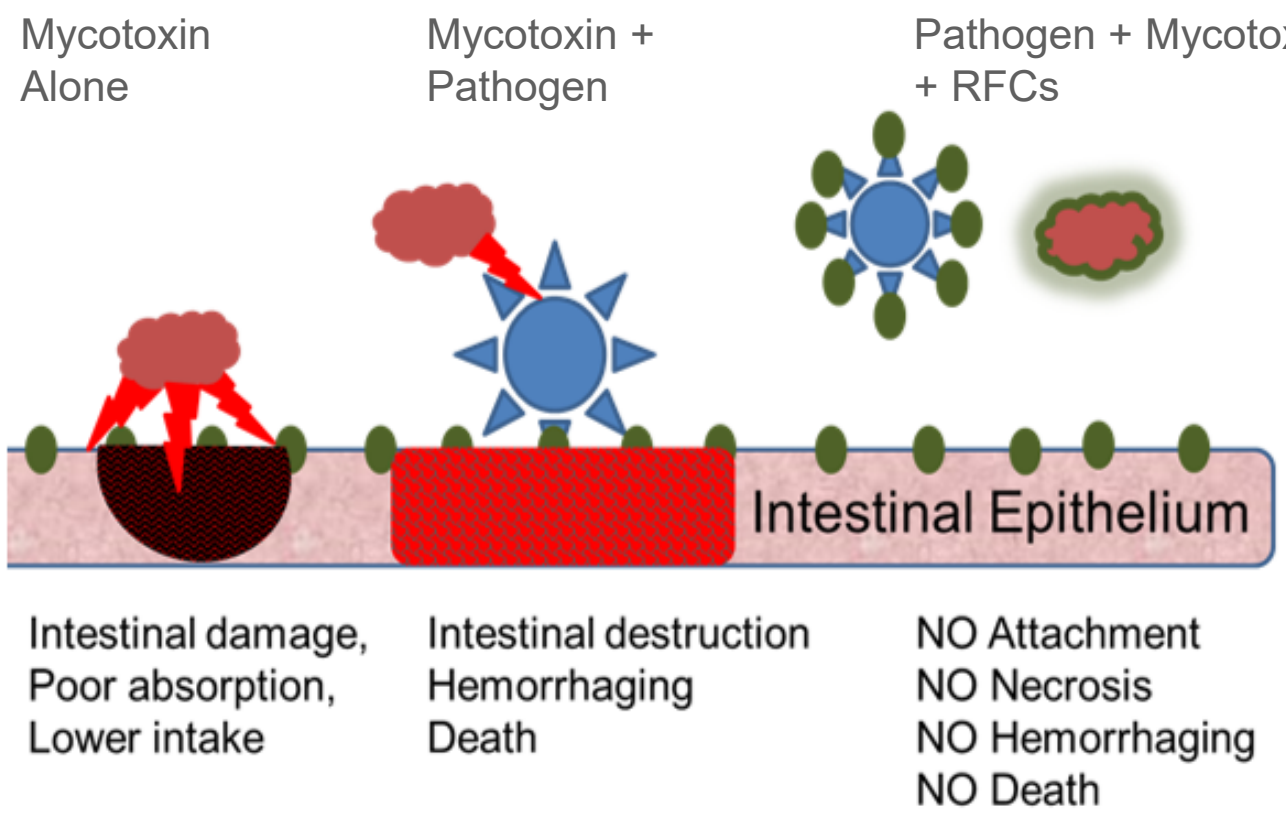
- Reduces the mycotoxin burden in the host by binding (PREVENT) and PROTECTING the gut epithelium from mycotoxin damage.

What it means?

- This PREVENT and PROTECT approach reduces both primary and secondary challenges caused by mycotoxins.
  - Can protect opportunistic pathogens from colonizing and infecting
  - A healthy gut epithelium, allows efficient feed assimilation
  - Restores immunosuppression and keeps animals protected from infections
  - Improved productivity and profitability for the producer

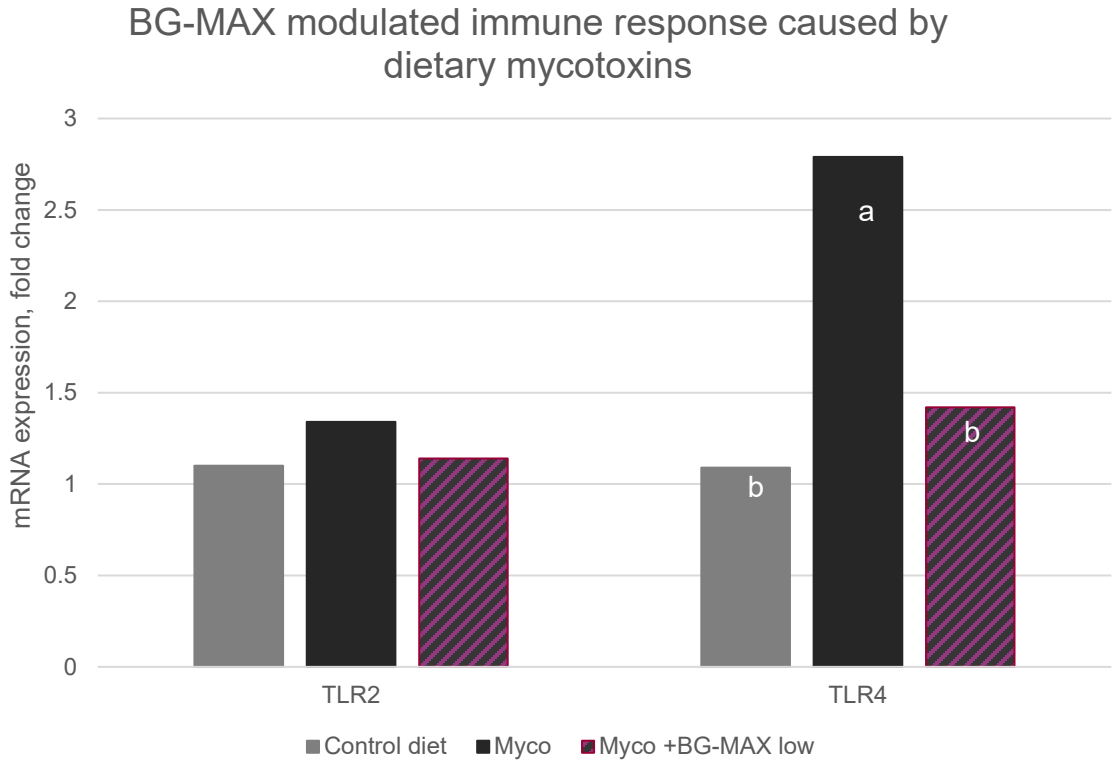
RESILIENCE

Mycotoxin damage in the gut allows opportunistic pathogens to colonize and cause secondary challenges



RESILIENCE

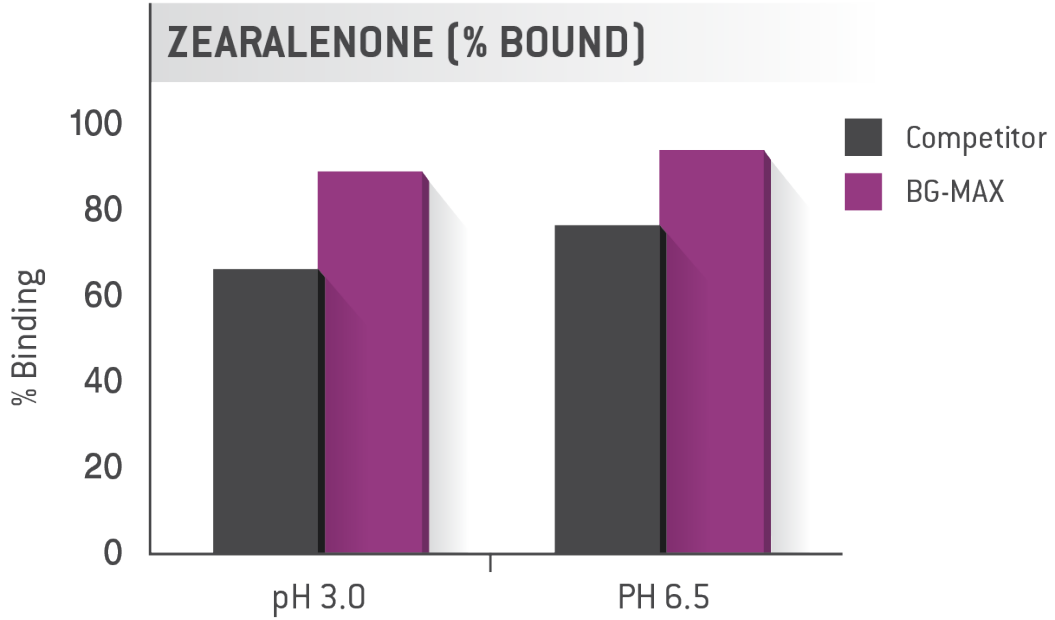
- Mycotoxins cause immunosuppression
- TLR2/TLR4 are membrane protein receptors, which are expressed on the surface of certain cells – they recognize foreign substances and pass on appropriate signals to the cells of the immune system
- **BG-MAX supplementation can restore immunity and keep animals protected from infections**



Zhao et. al. (2021) CAU Data on file

ZEARALENONE

- Zearalenone is the most detrimental mycotoxin to reproductive function.
- BG-MAX binds 80% Zearalenone, demonstrating its value in dairy diets.
- In a direct comparison in *in vitro* studies, BG-MAX **bound more** Zearalenone than competitor.



EFFECT OF BG-MAX ON MYCOTOXINS IN-VIVO

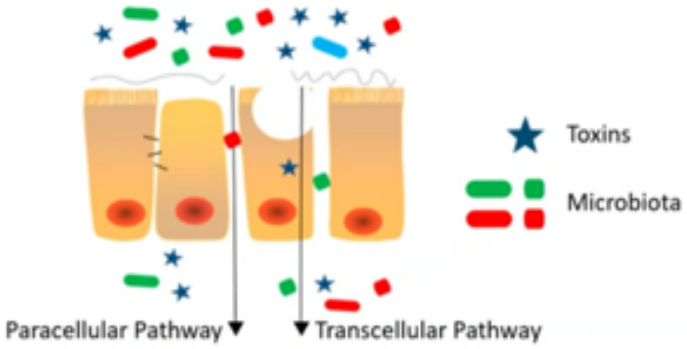
Mycotoxins Only

Aflatoxin Fumonisin **Zearalenone**
DON Ochratoxin Patulin T2

Oxidative Stress, ROS

Tissue Damage

Gut integrity is reduced, and permeability is increased



• Toxins migrate to organs • Secondary infections
• Suppress immunity • Poor gut morphology
• Reduced performance

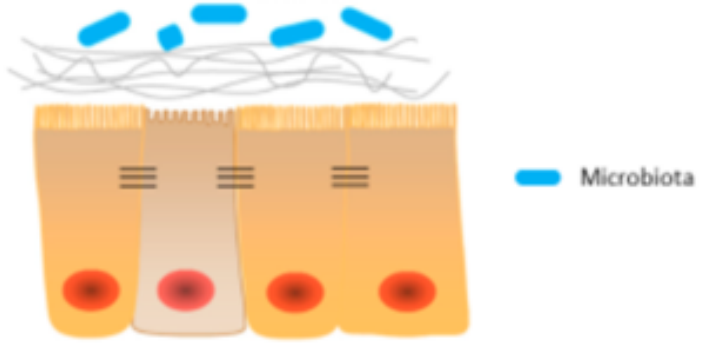
Mycotoxins + BG-MAX

Aflatoxin Fumonisin **Zearalenone**
DON Ochratoxin Patulin T2

Reduced Oxidative Stress, ROS

Less Tissue Damage

Gut integrity is maintained, and permeability is decreased



• Less toxins migrate to organs
• Less Secondary infections • Restore immunity
• Better gut morphology • Improved performance

WHAT DOES THE PERFECT MYCOTOXIN SOLUTION LOOK LIKE?

- ✓ Efficacious to **prevent** ingested multiple mycotoxins, at different concentrations, causing cellular damage and rupture, at all life stages, in all livestock species
- ✓ **Prevents** the risk of mycotoxins from entering the food chain through livestock production
- ✓ **Protects** against mycotoxin induced secondary pathogen challenges
- ✓ **Builds** animal resilience to continued mycotoxin exposure with enhanced immune status
- ✓ Is a cost-effective solution to mitigate the harmful effects of mycotoxins in all livestock species at various life stages
- ✓ Is easy to use, without restriction

BG-MAX™

ARM & HAMMER
ANIMAL NUTRITION

QUESTIONS?

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