MYCOTOXINS

AFLATOXINS - AFL
AFB1, AFB2, AFG1, AFG2, AFM1

OCHRATOXINS – OCH
A, B, C

FUMONISINS - FUM
FB1 (75 % OF CONTAMINATIONS), FB2, FB3, FB3 ETC. (15 TYPES IN TOTAL)

ZEARALENONE - ZEA

TRICHOTHECENES – DON
TYPE A: T-2, HT-2 & METABOLITES, DAS, MAS
TYPE B: DON & METABOLITES, NIVALENOL

MYCOTOXIN CONTAMINATION: A GROWING GLOBAL CONCERN

Mycotoxin contamination is an increasingly important topic worldwide, driven by the rise in extreme weather conditions. Mycotoxins are toxic metabolites produced by fungi, with a complex relationship: a single toxin can be produced by multiple fungi, while a single fungus can produce several different mycotoxins.

These harmful substances can develop at various stages of the crop and feed supply chain, including during growth in the field, after harvest, or throughout storage, transportation, processing, and ingredient distribution.

To date, more than 500 mycotoxins have been identified, grouped into five main families: Aflatoxins, Ochratoxins, Fumonisins, Zearalenones, Trichothecenes.

Addressing mycotoxin contamination is critical to safeguarding food and feed safety, protecting animal health, and ensuring sustainable production.

THE MAIN CHALLENGES WITH MYCOTOXINS ARE:

1. **Limited identification**
   With 50 mycotoxins can be analyzed;
2. **Spot contamination**
   Mycotoxins are present at very low levels and not evenly distributed in crops;
3. **Hidden risk**
   Mycotoxins can not be identified/ quantified by sight, smell or taste;
4. **High stability**
   Mycotoxins are very stable and are not affected by heat, physical, chemical and acid treatments, even over time.

To identify and quantify most mycotoxins is a challenge, because all of them individually, as well as multi-contaminations, can cause zootechnical issues. Mycotoxins have largely distinct structures, metabolisms, and consequently levels of toxicity. The impact on animal production differs per species as well as life stage, the main areas being growth performance, reproduction, final product quality, metabolism and immunity.

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AFL

AFLATOXIN

AFB1, AFB2, AFG1, AFG2, AFM1 AFM2

Produced in storage

SOURCE

Aspergillus flavus, Aspergillus parasiticus.

COMMONLY FOUND IN

Small grains (wheat, barley, oats, sorghum), Corn, peanuts, cottonseed, nuts, oilseeds and their by-products.

MECHANISM

Aflatoxins are potent carcinogens. They form DNA adducts by binding to the guanine bases in DNA, leading to mutations and triggering cancer, particularly in the liver.

SENSITIVE SPECIES

Poultry (especially young ducklings, turkeys), Ruminants, Fish (especially trouts), Swine.

EU LIMITS

(only recommended, may vary per country and species):

- 20 ppb in feed materials
- 5 ppb in feed for dairy animals

Source: Reg. EC 574/2011

MAIN EFFECTS IN ANIMALS

Poultry

Reduced feed intake, impaired growth, liver damage and decreased egg production.

Swine

Growth retardation, liver damage, and increased susceptibility to diseases.

Cattle

Decreased milk production, Aflatoxin M1 excreted in milk (regulated), liver damage, immunosuppression and reproductive issues.

OCH

OCHRATOXINS

OCHRATOXIN A (OTA), OCHRATOXIN B, OCHRATOXIN C, OCHRATOXIN D

Mainly produced in storage

SOURCE

Aspergillus ochraceus and Penicillium verrucosum.

COMMONLY FOUND IN

Cereals (and their by-products), oilseeds (and their by-products), coffee.

MECHANISM

Ochratoxin A (OTA) disrupts protein synthesis by inhibiting phenylalanine-tRNA synthetase, leading to oxidative stress and damage to the kidney.

SENSITIVE SPECIES

High toxicity in horses, swine.

EU LIMITS

(only recommended, may vary per country and species):

- 50 ppb for feed materials
- 10 to 50 ppb for complete feed, depending on animal species

Based on draft European Commission recommendation, expected to be published by end of 2025

MAIN EFFECTS IN ANIMALS

Poultry

Nephrotoxicity, increased water intake, reduced growth, egg production and immunosuppression.

Swine

Severe kidney damage, urination, increased water intake, reduced growth rates and reproductive failure.

Cattle

Reduced milk yield, kidney damage, excessive urine production and immunosuppression.

Identity cards
MYCOTOXINS

FUM

FUMONISIN

FB1 (75% OF CONTAMINATIONS), FB2, FB3, FB4, 15 TYPES IN TOTAL

Produced in field

SOURCE

Fusarium verticillioides and Fusarium proliferatum.

COMMONLY FOUND IN

Maize (corn) and maize-based products, forage (hay/alfalfa), silage.

MECHANISM

Fumonisins inhibit sphingolipid biosynthesis by blocking the enzyme ceramide synthase, leading to the accumulation of toxic sphinganine, which disrupts cell membranes and signaling pathways.

SENSITIVE SPECIES

High toxicity in horses, swine.

EU LIMITS

(only recommended, may vary per country and species):

- 1 to 20 ppm in cereals, depending on type of cereal
- 1 to 20 ppm for complete feed, depending on animal species

Based on draft European Commission recommendation, expected to be published by end of 2025

MAIN EFFECTS IN ANIMALS

Poultry
Reduced growth rate, organ damage and altered immune function.

Swine
Porcine pulmonary edema (PPE), liver damage, reduced growth and increased mortality.

Cattle
Lower milk production, liver and kidney damage, ketosis.

Horses
Equine leukoencephalomalacia (ELEM) a neurological disease

ZEA

ZEARALENONE

PART OF THE RESORCYCLIC ACID LACTONE GROUP

Produced in field

SOURCE

Fusarium sporotrichioides and Fusarium graminearum

COMMONLY FOUND IN

Corn (maize), wheat, barley, oats, sorghum, oilseeds (and by-products), forage (hay, alfalfa), silage/haylage

MECHANISM

Zearalenone mimics estrogen by binding to estrogen receptors, leading to estrogenic effects in animals, particularly affecting reproductive health.

SENSITIVE SPECIES

Swine, both male and female, young ruminants.

EU LIMITS

(only recommended, may vary per country and species):

- 0.5 to 2 ppm in cereals, depending on type of cereal
- 0.1 to 2 ppm for complete feed, depending on animal species

Based on draft European Commission recommendation, expected to be published by end of 2025

MAIN EFFECTS IN ANIMALS

Poultry

Generally, less sensitive, but high levels can lead to reproductive issues and zearalenone has a dose-response impact on feed conversion ratio (FCR).

Swine

Highly sensitive, leading to vulvovaginitis, infertility, reduced litter size, and mammary gland swelling. In males, zearalenone delays sexual development, reducing libido and delaying puberty.

Cattle

In ruminants, zearalenone is less impactful, but its conversion to alpha zearalenone in the rumen increases its estrogenic effect (60 times more potent). This can lead to reduced milk yield, infertility, abortion and other reproductive disorders.

DON

TRICHOTHECENES

TYPE B: DEOXYNIVALENOL (VOMITOXIN) & METABOLITES, NIVALENOL

Produced in field

SOURCE

Fusarium sporotrichioides and Fusarium graminearum

COMMONLY FOUND IN

Wheat, barley, maize, oats, all silage types and forages (hay)

MECHANISM

Trichothecenes inhibit protein synthesis by interfering with ribosomal function, leading to cell death and immunosuppression.

SENSITIVE SPECIES

Poultry (broiler and laying hens, turkey), swine (piglets), Fish (especially trout).

EU LIMITS

(only recommended, may vary per country and species):

- 0.5 to 8 ppm in cereals, depending on type of cereal
- 0.5 to 5 ppm for complete feed, depending on animal species

Based on draft European Commission recommendation, expected to be published by end of 2025

MAIN EFFECTS IN ANIMALS

Poultry

Reduced feed intake, growth retardation, and immunosuppression.

Swine

Vomiting, feed refusal as an effect of DON having severe impact on the GIT, growth retardation, and immunosuppression.

Cattle

Decreased feed intake, immunosuppression, Deoxynivalenol (DON) severely impacts ruminants by disrupting the rumen. It alters the pH, which harms microbial protein synthesis and reduces the production of volatile fatty acids, a key energy source. This leads to decreased growth rates and lower milk production, ultimately affecting overall productivity.

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T2

TRICHOTHECENES

TYPE A: T-2, HT-2 & METABOLITES, DAS, MAS

Produced in field

SOURCE

Fusarium sporotrichioides and Fusarium graminearum

COMMONLY FOUND IN

Corn (Maize) and by-products, Cereals (small grains) and its by-products

MECHANISM

Trichothecenes inhibit protein synthesis by interfering with ribosomal function, leading to cell death and immunosuppression. T-2 toxin targets epithelial cells in the gastrointestinal tract, skin, and lymphatic system, causing irritation, necrosis, and damaging DNA synthesis. It is a strong immune suppressant.

SENSITIVE SPECIES

Poultry (broiler and laying hens, turkey), swine (piglets), Fish (especially trout).

EU LIMITS

(only recommended, may vary per country and species):

- 0.2 to 3 ppm in cereals, depending on type of cereal
- 0.05 to 0.5 ppm for complete feed, depending on animal species

Based on draft European Commission recommendation, expected to be published by end of 2025

MAIN EFFECTS IN ANIMALS

Poultry

Oral lesions and damage to the digestive tract, impairing the bird's ability to ingest and process food (feed refusal), leading to poor nutrient absorption, reduced growth rates, and lower egg production. It can also result in abnormal feathering, affecting the bird's ability to protect itself from environmental stress.

Swine

Severe liver and intestinal bleeding, leading to immediate health concerns and reduced productivity. Dermal effects, like skin irritation and necrosis at higher doses. Chronic exposure reduces feed intake, causing weight loss and lower growth rates. It can also lead to birth defects, impacting reproductive success and reducing viable offspring.

Cattle

gastrointestinal distress, including bloody diarrhea, nutrient loss, dehydration, and discomfort. Like other mycotoxins, it reduces feed intake, negatively affecting reproduction, growth, milk production, and overall profitability.