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Impact of Mycotoxins on Poultry Health Clinical signs, Risk Management and Control

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Key message

- Mycotoxins such as aflatoxins, ochratoxins, fumonisins, and trichothecenes commonly contaminate poultry feed and adversely affect growth, immunity, reproduction, and overall productivity.
- Mycotoxicosis often causes reduced feed intake, poor weight gain, lower egg production, immunosuppression, increased disease susceptibility, and significant economic losses in poultry production.
- Effective prevention requires good agricultural and storage practices, regular feed testing, proper moisture control, and the use of suitable mycotoxin binders to reduce toxin absorption and minimize health risks.

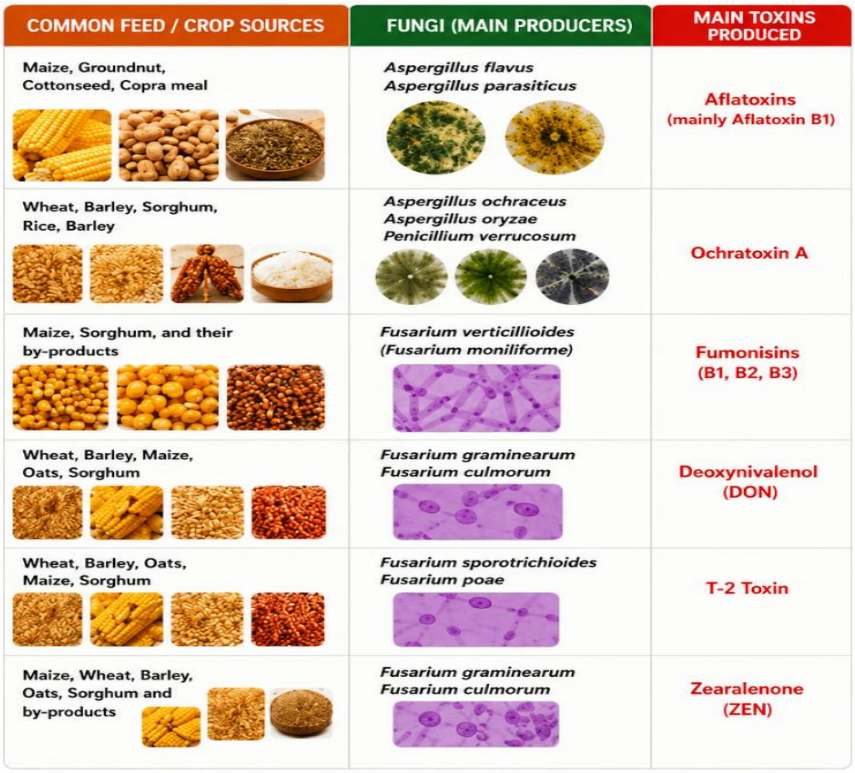
Abstract

Mycotoxin contamination of poultry feed is a major challenge affecting bird health, productivity, and profitability worldwide. Poultry feeds containing cereal grains and protein-rich ingredients are highly susceptible to fungal contamination under conditions of high humidity, elevated temperature, poor ventilation, and prolonged storage. Fungi belonging to the genera *Aspergillus*, *Penicillium*, and *Fusarium* produce important mycotoxins, including aflatoxins, ochratoxin A, fumonisins, deoxynivalenol, T-2 toxin, and zearalenone. These toxins can impair growth, feed efficiency, immune function, reproduction, and gut health, while increasing susceptibility to infectious diseases. Diagnosis of mycotoxicosis involves clinical evaluation, feed analysis, pathological examination, and laboratory techniques such as ELISA, HPLC, TLC, and LC-MS/MS. Economic losses arise from reduced production performance, increased mortality, poor vaccine response, and higher treatment costs. Prevention and control strategies include implementation of good agricultural and storage practices, routine monitoring of feed quality, maintenance of low moisture levels, and the use of effective mycotoxin binders and biotransforming agents. An integrated management approach is essential to minimize the impact of mycotoxins and ensure sustainable poultry production.

Introduction

Poultry farming majorly depends on protein rich feeds and cereal grains which are easily prone to contamination by fungi. Fungal growth initiated by the presence of environmental factors such as high humidity, high temperatures, inadequate ventilation, and

long storage periods. Broilers and layers are highly susceptible to toxins like aflatoxins and trichothecenes due to there high metabolic rates and high feed intakes. Contamination of poultry feeds with mycotoxins is a challenge for the poultry farmers which causes harmful effects on bird health and production. These toxins occur together in feeds and tend to act synergistically which leads to huge loses in poultry industry.



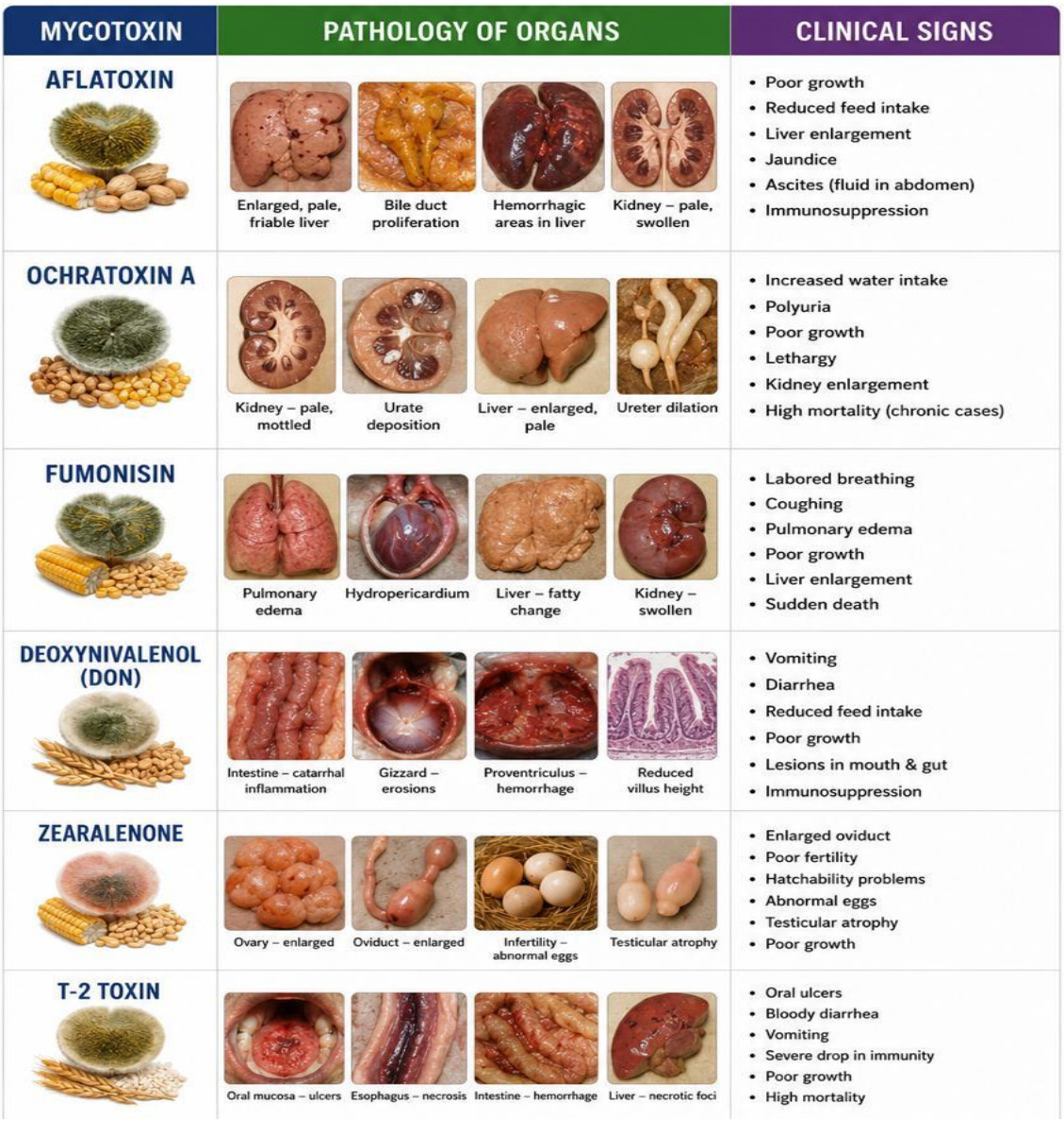
Mycotoxin Sources

Out of more than 350 mycotoxins identified in nature, aflatoxins (AF), citrinins (CIT), fumonisins (F), ochratoxins (OT) and tricothecenes are the most common and important in poultry.**Fig1** shows feed ingredients are susceptible to contamination by *Aspergillus*, *Penicillium*, and *Fusarium* species, leading to the production of major mycotoxins such as aflatoxins, ochratoxin A, fumonisins, deoxynivalenol (DON), T-2 toxin, and zearalenone (ZEN).

Clinical signs

The signs that are presented are influenced by various factors including the type of toxin, dosage and exposure period. Reduced growth rate, feed consumption and increased mortality, lethargy, diarrhoea seen in broiler chickens. On Post-mortem examination reveals enlarged, pale petechial haemorrhage in severe aflatoxicosis. Decreased egg production, improper shell formation, decreased hatching rate, and reproductive issues seen in layers. Long-term exposure usually causes immunosuppression making the birds susceptible to Newcastle disease, infectious bursitis, coccidiosis and others. In addition, they alter the immune response, reduce gut integrity and induce lesions on the intestinal epithelium, regulate

cytokine production and reduce vaccine responses in poultry flocks.



Pathological changes and clinical manifestations associated with mycotoxins

Mycotoxicosis Diagnosis and Laboratory Tests

The process of diagnosing mycotoxicosis in poultry requires a thorough evaluation of history of the flock, feed examination, symptoms, pathological signs and laboratory tests. The distribution of the mycotoxins in feeds is uneven, thus there is need for adequate sampling for effective diagnosis. The most common methods used in diagnosing mycotoxicosis in feedstuffs are ELISA,(enzyme linked immunosorbent assay), HPLC,(performance liquid chromatography), TLC and (thin layer chromatography)LC-MS/MS.(liquid chromatography–mass spectrometry). Histopathology of the liver reveals fatty degeneration ,kidneys shows necrotic changes and intestine shows inflammatory changes.

Mycotoxin	The maximum recommended levels
Aflatoxin B_1	< 20 ppb (0.02 ppm)
Ochratoxin A	< 50 ppb (0.05 ppm)
T-2 Toxin	< 100 ppb (0.1 ppm)
Deoxynivalenol (DON, Vomitoxin)	< 5 ppm
Zearalenone (ZEN)	< 0.25–0.5 ppm
Fumonisin (FB_1 + FB_2)	< 20 ppm
Citrinin	< 100 ppb (0.1 ppm)
Ergot Alkaloids	< 0.1 ppm

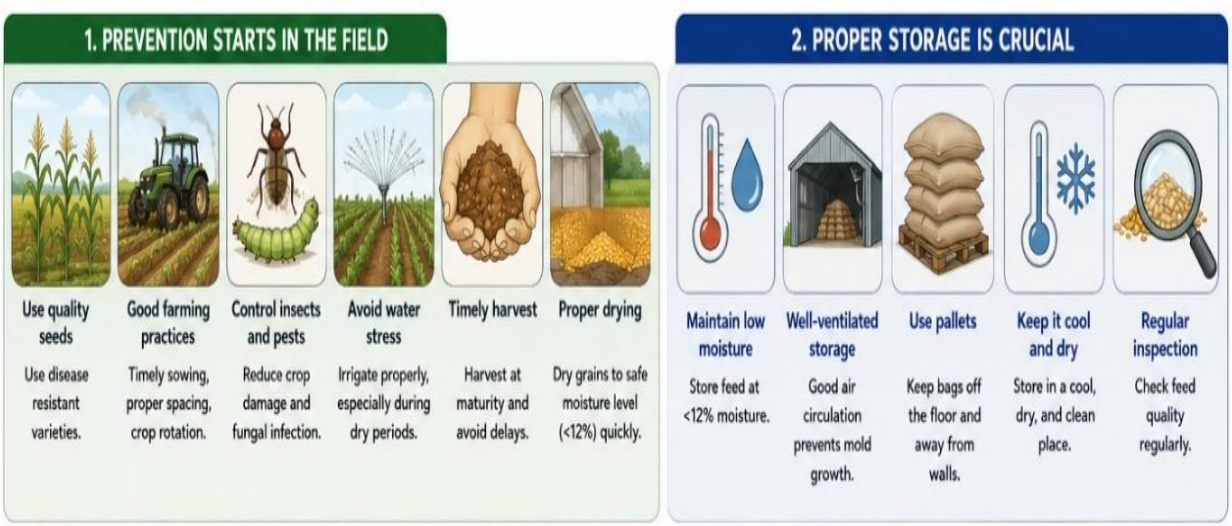
(Ref-Bryden, 2012; FAO, 2003; WHO, 2018).

Economic Impact on Poultry Industry

Mycotoxins will reduce the economic efficiency of poultry production systems to a large extent. Feed is one which accounts for the largest proportion of poultry production costs and hence mycotoxin contamination in feed directly influences the economics of the business. It leads to tremendous economic losses by causing decreased body weight gains, poor feed conversion rates, mortalities, low egg production, low hatchability rates, and high veterinary expenses. Immunodeficiency caused by mycotoxins leads to poor vaccine efficacy, leading to increased mortality and treatment costs due to greater vulnerability to infections. Even low concentration of toxins can cause chronic subclinical losses that are difficult to recognize. Poultry farming systems around the world are adopting quality assurance programs ,routine feed testing , and toxin management strategies to reduce economic losses.

Precautions to Control Mycotoxins in feed

Precautions to control mycotoxins in feed is through Good Agricultural Practices (GAP)which include harvesting at the appropriate time, grain drying, proper storage conditions, proper storage of the feed in terms of moisture levels, ventilation, controlling insects and rodents and using crop varieties that resist the growth of fungi. The grains must be dried rapidly to below 12% moisture following harvest and stored under conditions that are free from pests. **Fig. 3** shows preventive measures to reduce mycotoxin contamination in feed through good field practices and proper storage management



Mycotoxin binders:

The Mycotoxin Binders are compounds that bind to mycotoxins making them inactive prior to absorption in the animal's system. There is no single antidote for mycotoxicosis to poultry. Immediate removal of the contaminated feed is the most important aspect of treatment. Since different mycotoxins have different structures, there is no single method to deactivate mycotoxins in feed**.**

Binder Type	Examples
Inorganic Binders	Bentonite, Zeolite, HSCAS (Hydrated Sodium Calcium Aluminosilicate)
Organic binders	Esterified Glucomannan (Yeast Cell Wall), MOS (Mannan Oligosaccharides), β-Glucans
Biotransforming agents	*Bacillus subtilis, Eubacterium BBSH 797*
Multi-component Binders	Combination of Clay + Yeast + Enzymes + Probiotics

Conclusion

Mycotoxins remain to pose health productivity and economic loss for poultry. Aflatoxins, ochratoxin A, fumonisins and trichothecenes are toxins which show impact on the growth, immune system, reproduction and feed efficiency of poultry. Since the toxic effects of these toxins is mainly sub-clinical, therefore early diagnosis and prevention measures are crucial. Control of mycotoxins needs to be tackled in an integrated manner, such as safe feed storage, periodic testing for toxins, use of toxin binding agents, and nutritional management.

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