Indian Veterinary Magazine
a monthly Magazine
of the people, by the people, for the people
Vol 2 Issue 1 Jan 2026, 17-27
ISSN:3108-1398

T-2 Toxin: *Incidence and Toxicity in Backyard Poultry*

Dr. Suresh F. Nipane
Veterinary Officer, Ph.D. (Animal Nutrition)

Introduction:

T-2 toxin is a member of a large group of fungal metabolites with the same basic chemical structure, called trichothecene mycotoxins. There are nearly 190 closely related chemical compounds in the group of trichothecene toxins, named after the first isolated trichothecene molecule *trichothecin.* T-2 toxin is the most toxic type A trichothecene mycotoxin. It is the secondary metabolite of the *Fusarium* fungi, and is common in grain and animal feed. Toxic effects have been shown both in experimental animals and in livestock. If at the onset of the disease, a change in diet leads to health and performance improvements in animals, this may point to mycotoxin poisoning.

Table 1: Occurrence of different key mycotoxins

Mycotoxin	Fungi Produced	Commodities affected
Aflatoxin	*Aspergillus flavus*	Corn, cotton seed,
	Aspergillus parasiticus	peanuts, soybean
Ochratoxin A	*Aspergillus ochraceus*	Wheat, barley, oats,
	Aspergillus nigri	oats, corn, others
	Penicillium verrucosum	
Trichothecenes	*Fusarium graminearum*	Corn, wheat, barley
(DON, T-2, DAS, etc)	*Fusarium culmorum*	
Zearalenone	*Fusarium graminearum*	Corn, wheat, barley, grass
Fumonisin	*Fusarium verticillioides*	Corn
	Fusarium proliferatum	
Moniliformin	*Fusarium moniliforme*	Corn

Adapted from Bhatnagar *et al*., 2004

Toxic Effect:

- Secondary metabolites (chemicals) of a fungus that produce toxic results in another organism.
- Cytotoxic: Disrupt cell structures such as membranes, and processes such as protein, DNA, and RNA synthesis.
- Immunomodulation, cell lesions in the digestive tract, organs and skin, neural disturbances and low performance in poultry production (decreased weight gain, egg production, and hatchability).
- Concentrations of T-2 toxin in feed are usually low, and its immunosuppressive effects and secondary infections often make diagnosis difficult.

Mycotoxin Statistics:

- 300-400 mycotoxins presently identified, with more becoming evident as new isolation techniques are used.
- Most frequent toxins present are aflatoxin, DON, ZEN, fumonisin, and T-2 toxin, to name a few.

Mechanism of action:

After exposure by the oral, dermal or inhalation route, T-2 toxin can cause severe effects in various animal organs and tissues. So far, toxic effects have been evidenced in the cells of fungi, protozoa, insects, moulds, plants, and different cell cultures. In poultry, the toxic effects of T-2 toxin can be classified as genotoxic and cytotoxic, immunomodulatory effects, effects on the cells of the digestive system and liver, effects on the nervous system and skin and impairment of poultry performance.

Factors affecting mycotoxin formation in the field:

As temperature and moisture levels are key factors for fungal growth and subsequent mycotoxin production, the climate plays a key role in the occurrence of mycotoxins. Three key agronomic factors have been shown to affect mycotoxin presence and concentration significantly:

1. **Crop presence and rotation**
2. **Soil cultivation**
3. **Crop and crop varieties**

Quick Toxin Review:

Organ System Affected	Toxin(s)
Vascular	Aflatoxin
Digestive	Aflatoxin,T-2 toxin, Vomitotoxin
Respiratory	Aflatoxin,Trichothecenes
Nervous	Aflatoxin,Trichothecenes
Cutaneous	Tricothecenes
Urinary	Ochratoxin A, Citrinin
Reproductive	Zearalenone, T-2 toxin
Immune	Many

Modes of Spore Transmission:

- Airborne, wind or indoor ventilation systems.
- Attachment to insects of birds thus transmitted from plant to plant, or animal to animal, etc.
- Via transportation mechanisms such as trucks, crop machinery, etc.

Fungal Growth

- Relative humidity over 70%.
- Temperatures over 30 degrees Celsius for a period of a few days to a week.
- Stress to the affected plant, such as drought, flood, or insect infestation.
- High moisture content of crop (20% or higher).
- Must occur in conjunction, or fungal growth cycle will cease.

Mycotoxin Health Hazards:

- Generally lower risk in well developed countries due to improved standards of living.
- High intake of affected product, usually in conjunction with limited amounts of other food sources.
- Greatest threat comes from long term exposure due to eating spoiled food or meat from animals fed contaminated feed.

Most fungi do not produce Mycotoxins:

- Many fungi are edible
- Mushrooms are fungi
- Moldy feeds may be degraded without presence of mycotoxin, or may be unaffected in value.

Feeds most Susceptible to Fungi-producing Mycotoxins:

- Corn
- Wheat
- Oats
- Barley
- Sorghum
- Cottonseed
- Peanut meal
- Rye

Moldy grain is usually nontoxic:

- Competition between toxic and nontoxic molds.
- Entire mold population is not producing mycotoxin
- Conditions for growth are different for mold growth vs mycotoxin production

Factors causing variation in effects

- Species
- Breed
- Age
- Sex
- Nutritional status
- Other diseases
- **Other mycotoxins**
- Extent of exposure

Trichothecene Mycotoxins

- Nivalenol
- Deoxynivalenol

- T-2 toxin
- HT-2 toxin
- Diacetoxyscirpenol
- Triacetoxyscirpendiol
- Fusarenone X
- Verrucarin A, B, J
- Roridin A, D, E, H
- Many Others (29+)

These are “field” toxins, not “storage” toxins

Symptoms of Mycotoxicosis:

1. Drugs and antibiotics are not effective in treatment.
2. The symptoms can be traced to foodstuffs or feed.
3. Testing of said foodstuffs or feed reveals fungal contamination.
4. The symptoms are not transmissible person to person.
5. The degree of toxicity is subject to persons age (more often in very young and very old), sex
   (more often in females than males) and nutritional status.
6. Outbreaks of symptoms appear seasonally

Regulatory Control:

- In 1965, the Food and Drug Administration (FDA) set the first mycotoxin limit of 20 parts per billion (ppb) for aflatoxin in all foods and feed.
- But, this toxin can appear at varying levels of food production, so multiple testing at different points in the food chain is necessary.
- Using ELISA (enzyme-linked immunosorbent assay) technology, testing can be done cheaper and faster than previously.
- The FDA does not do the testing, various other agencies do, such as the Grain Inspection Packers and Stockyards Administration; but, toxic levels must be reported to the FDA.

DON and T-2 Toxin:

- These are tricothecenes of wheat, grain, and barley.
- They cause necrosis and hemorrhage of the digestive tract, decreased blood production in the bone and spleen, and changes to reproductive systems.

- In poultry, causes reduced egg production, beak lesions, and abnormal feathering
- Optimal temperature range is between 70 and 85 ^{0} F
- Advisory level of DON is 1 ppm.

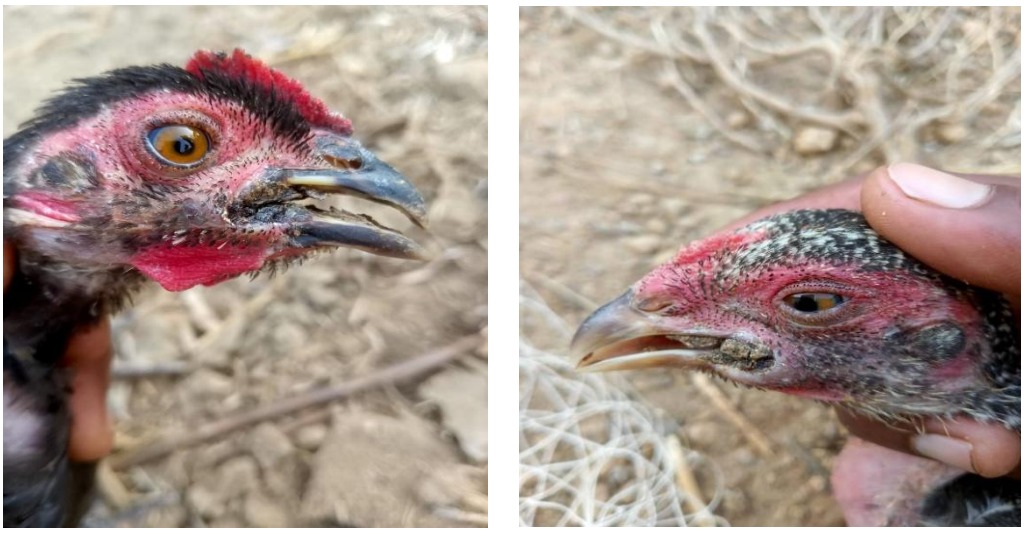

Photo: Chick showing stomatitis attributed to T-2 fusariotoxicosis of backyard poultry

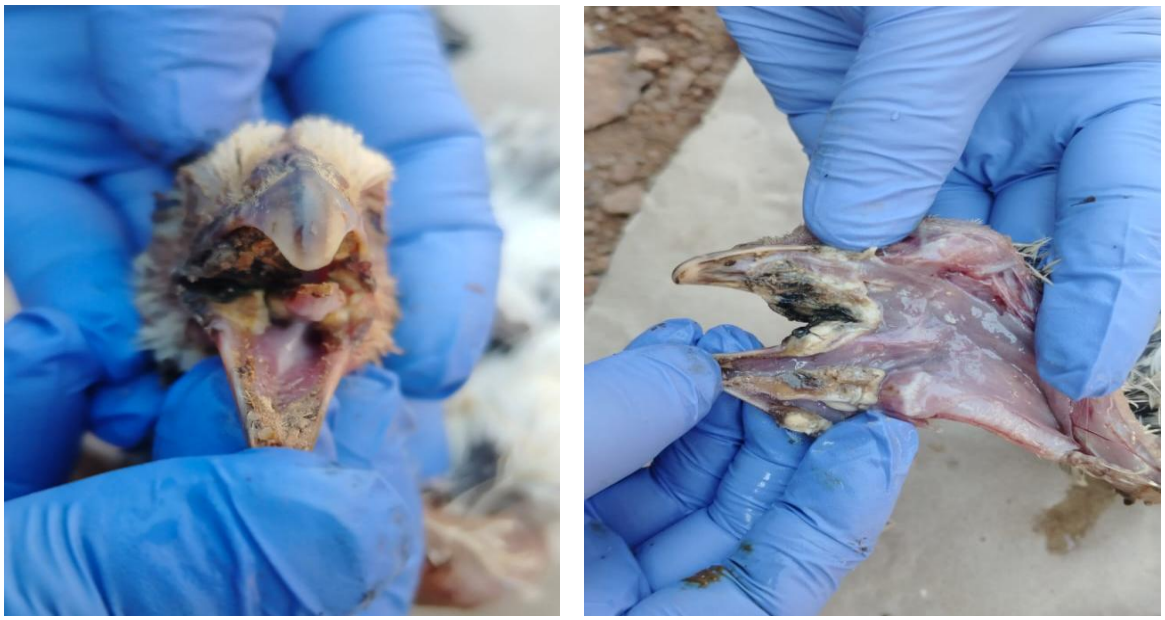

Photo: Stomatitis following consumption of T-2 fusariotoxin

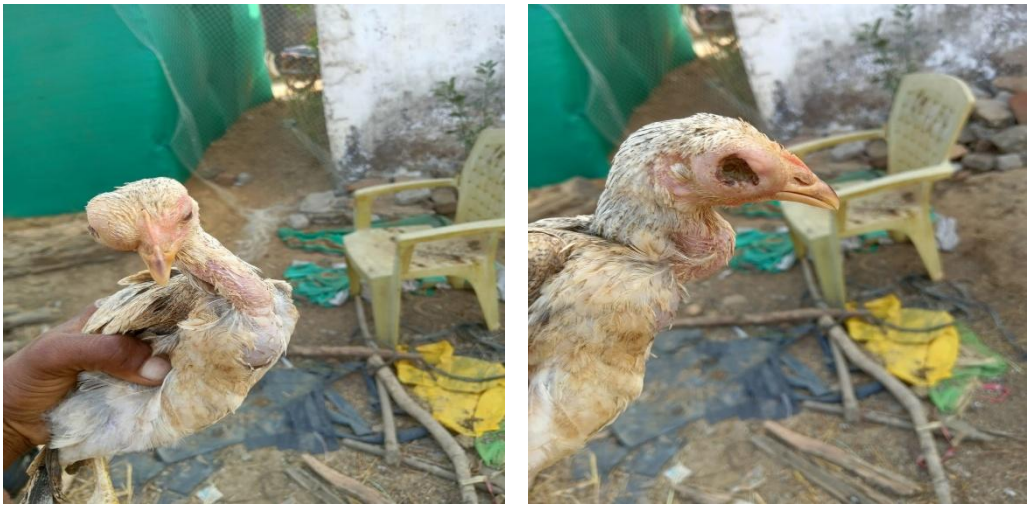

Photo: Meningoencephalitis

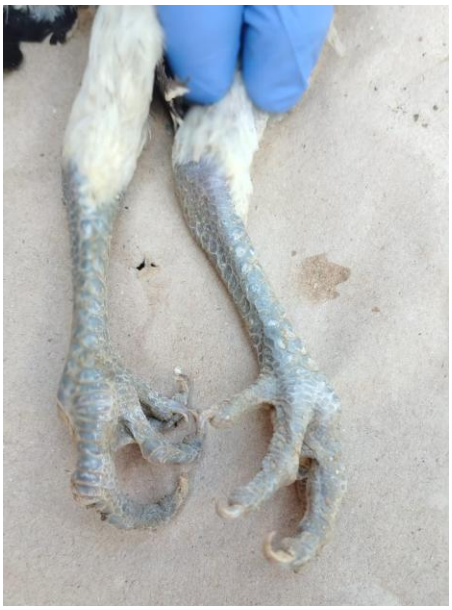

Photo: Arthritis

Prevention and Control:

Use clean eggs free of cracks and fresh litter free of hard wood, dusty rice hulls and peanut hulls. Maintain a clean environment in the hatchery and during brooding.

Treatment:

Treatment is very difficult as soon as the infection has been established, although enilconazole, sprayed in the house, is known to aid in preventing new infection. There is a regulatory issue here, as disinfection of the environment in presence of animals could be illegal in European conditions. Several disinfectants are used for prevention, but care should be given to the claimed activity and safety in use. Several producers claim a sporocidal activity, but when taking a closer look at the activity, the sporocidal activity is only evident after a very long contact time and/or high concentration. Fungal spores are extremely difficult to destroy by disinfection. Some of these compounds work on the metabolism, so when spores are not sporulating, they cannot exert their activity. When these compounds are washed away from the spores, they will be able to sporulate again. These compounds should be called anti-sporulant instead of sporocidal.

Future Fight against Mycotoxins:

- Have farmers select strains resistant to contamination.
- Scientists hope to genetically engineer plants resistant to fungal infection.
- Use feed additives that sequester the toxins and prevent absorption from the gastrointestinal tract

Feeding Strategies:

As the risk if mycotoxicosis is very difficult to predict or evaluate, prevention strategies should be initiated when assessing even a low risk situation. Prevention strategies must primarily aim at minimising mycotoxin formation in the field and during storage.

A significant reduction in mycotoxin formation can be achieved by good agronomic practices, for example:

1. Selection of crop varieties that are more resistant to fungal foliar diseases
2. Ploughing up harvest residues
3. Avoiding no-till soil management practices
4. Proper crop rotation
5. Avoiding monoculture

During storage of dry feed ingredients, mycotoxin formation can be successfully controlled by monitoring the moisture content of the feed. If the moisture content is below

12%, moulds become metabolically inactive, and the risk of mycotoxin formation is strongly reduced. To avoid mycotoxin formation, be aware of the following:

1. Moisture content below 12%
2. Relative humidity below 60%
3. Storage temperature below 20 °C
4. Clear grain, avoid broken kernels
5. Control insects and rodents
6. Avoid stress (rost, heat, pH changes)

Mycotoxin adsorbents and binders:

As we know mycotoxins are usually found in combinations in complete animal feeds. A broad substrate binding capacity will ensure at least some fraction of all the mycotoxins will be rendered non-bioavailable and the bioavailable mycotoxins will be below the threshold of biological activity. Broad substrate binding capacity of a binding agent will also minimise the potential for toxicological synergy between mycotoxins.

Speciality feed additives, known as mycotoxin adsorbents or binding agents are the most common approach to prevent and treat mycotoxicosis in animals. It is believed that the agents bind to the mycotoxin preventing them from being absorbed. The mycotoxins and the binding agent are excreted in the manure.

The effective level of dietary inclusion for mycotoxin adsorbents will depend on the mycotoxin binding capacity of the adsorbent and the degree of contamination of the feed in question. A high binding capacity will minimise the level of inclusion and minimise the reduction in nutrient density caused by the feeding of the adsorbent. High levels of inclusion of adsorbents can also alter the physical properties of the feed which might impair feed processing such as pellet formation, in addition to altering the actual diet specification.

Mycotoxin binding is achieved through both:

- **Physical adsorption**
- **Relatively weak bonding involving van der Waals interactions and hydrogen bonding**
- **Chemical Adsorption:** (Chemisorption) is a stronger interaction which involves ionic or covalent bonding.

An effective binder or sequestering agent is one that prevents or limits mycotoxin absorption from the gastro-intestinal tract of the animal. In addition, they should be free from

impurities and odours. Be aware that not all are equally effective. Many can impair nutrient utilisation and are mainly marketed, based on in-vitro data only.

There are two types of mycotoxin adsorbent/binder:

- Inorganic binders
- Organic adsorbents

Inorganic binders:

Inorganic mycotoxin binders are silica based polymers. Examples could include:

1. Zeolites
2. Bentonites
3. Bleaching clays from the refining of canola oil
4. Hydrated sodium calcium aluminosilicates (HSCAS)
5. Diatomaceous earth
6. Numerous clays

They can be grouped into two categories: **Phyllosilicates** and **Tectosilicates**

Phyllosilicates: *bentonites/montmorillonites* :

1. Phyllosilicates are characterised by alternating layers of tetrahedral silicon and octahedral aluminium coordinated with montmorillonite oxygen atoms
2. Isomorphous substitution leads to a net negative charge which must be satisfied by the presence of inorganic cations (Na, Ca, Mg, K)
3. Applications: Adsorbents for heavy metals, suspension-stabilising agents in coatings, bonding agents for foundry sands and washes, binder in pelletisation processes, desiccants in feed products.

Tectosilicates: *Zeolites* :

1. Tectoalumosilicates of alkali and alkaline earth cations that have an infinite three-dimensional cage-like structure
2. Isomorphous substitution leads to a net negative charge which is satisfied by the presence of inorganic cations (Na, Ca, Mg, K)
3. Applications: Adsorbents for ammonia, heavy metals, radioactive cesium and mycotoxins.

Organic Adsorbents:

Organic mycotoxin adsorbents are carbon based polymers. Examples could include:

Fibrous plant sources such as:

- Oat hulls
- Wheat bran
- Alfalfa fibre
- Extracts of yeast cell wall
- Cellulose
- Hemi-cellulose
- Pectin

Such materials are biodegradable but can, in some cases, also be vectors of mycotoxin contamination. Benefits of yeast cell wall are low inclusion, high surface area and certainly no toxic contaminants. The efficacy of glucomannan-containing yeast products as mycotoxin adsorbents in feeds has been investigated globally with several studies with all animals

Mycotoxin adsorbents offer an attractive short-term solution to the challenge of mycotoxin-contaminated animal feeds. The only complete solution to the mycotoxin challenge will be the long-term goal of eliminating mycotoxins from the food and feed chains through improved quality control based on better analytical techniques coupled with genetic advances in plant resistance to fungal infestation.

Mycotoxin adsorbent should be:

- Proven efficacy *in vivo* as well as *in vitro*
- Low effective inclusion rate
- Stable over a wide pH range (This is necessary so that the mycotoxin stays attached to the adsorbent throughout the gut and is excreted.)
- High affinity to adsorb low concentrations of mycotoxins
- High capacity to adsorb high concentrations of mycotoxins
- Ability to act rapidly before the mycotoxin can be absorbed into the blood stream.