



Fumonisin fact sheet

Poisonous compounds or toxins may be produced by various fungi. These compounds are called “mycotoxins”. More than four hundred mycotoxins have been identified. Only a small number of these mycotoxins affect livestock feeding and production.

A. What is “fumonisin”?

1. Mycotoxin produced by strains of *Fusarium* molds

- Primarily produced by *Fusarium verticillioides* (*F. moniliforme* is older name) and *F. proliferatum*
- May be produced by other *Fusarium* species
- Molds grow on agricultural commodities in field or during storage
- F. verticillioides* adapted to warmer climate; less prevalent in corn grown in northern areas

2. Considered potent human carcinogens (cancer-causing agents)

- Are associated with adverse health effects in livestock
- More than ten types of fumonisin have been identified
 - Major types are fumonisin B₁ (FB₁), fumonisin B₂ (FB₂), and fumonisin B₃ (FB₃)
- Fumonisin FB₁ is most prevalent in contaminated corn
 - Considered to be most toxic

B. Fumonisin “guidance levels”

1. Levels set by U.S. Food and Drug Administration (FDA)

- Applied to corn and corn products
- “FDA believes that controlling fumonisins to ... recommended levels can reduce exposure to fumonisins that may be found in corn products intended for human and animal consumption.”

2. Guidance levels depend on commodity and species

- Considered by FDA as:
 - “... adequate to protect human and animal health...”
 - “... achievable in human foods and animal feeds with the use of good agricultural and good manufacturing practices...”

3. Guidance levels based on total fumonisin levels (FB1 + FB2 +FB3)

- Human foods: maximum 2 to 4 ppm
 - ppm = “parts per million”
 - ppm = milligrams per kilogram (mg/kg)
- Animal feeds
 - Maximum 5 to 100 ppm for single ingredient

- Corn or corn by-products (up to maximum levels) should not make up more than 50% of diet for most animals
- Corn or corn by-products (up to maximum levels) should not make up more than 20% of diet for horses or rabbits

C. Conditions favoring fumonisin production

1. *Fusarium* molds

- Are associated with ear rots and stalk rots
 - Are soil-borne pathogens
 - Crop residue is source of spores
 - Can develop under wide range of environmental conditions
- Can infect seedlings and developing kernels
 - F. verticillioides* more capable of growing into non-injured plant tissue; e.g., intact kernels
 - Affected kernels may appear purple, tan, or brown
 - Visible mold appears white to pink or salmon-colored

2. Corn, in-field conditions

- Hot, dry conditions during midseason
- Followed by cool and moist conditions during pollination and kernel formation
- Insect or hail damage to ears
 - Create entry wounds
 - Insects can transport fungus
- Warm, wet weather at harvest

3. Corn, in storage

- Optimal mold growth if moisture content is 18% to 23%
- Fungal growth and fumonisin production cease below 18% moisture

D. Fumonisin effects

1. Few effects in most animals, except horses

- Primarily attacks liver, kidneys
- Swine
 - Reduced immunity
 - Pulmonary edema
- Pigs and chicks
 - Interferes with normal bone development
- Cattle
 - Appear to be least susceptible

2. Horses

- Affects horses drastically and quickly after ingestion
- Equine leukoencephalomalacia (ELEM)
 - Symptoms appear within 7 to 30 days

- ii. Disorientation (walking/agitation), derangement
- iii. Colic
- iv. Head-pressing
- v. Blindness, “blind staggers”
- vi. Death

- i. Coupling reaction between specific mycotoxin and antibodies specific for that mycotoxin
- ii. Test kit only
 - 1) Screening test to provide yes/no answer
- iii. Test kit with reader
 - 1) Provides quantitative data
- b. High performance liquid chromatography (HPLC)
 - i. Can test all mycotoxins
 - ii. More sensitive; provides quantitative data at lower detection limits than ELISA
 - iii. Requires more time; more expensive

E. Sampling and analysis

1. Survey fields before harvest

- a. From dent through to harvest, check five to ten field locations
- b. Target areas with plants that appear most stressed.
- c. Peel back the husks of 10 ears at each location and inspect for mold

2. Suggested sampling procedures

- a. Standing grain: Collect 25 ears or heads at random throughout the field
- b. Grain cart/truck: Take multiple probes for a composite 10 lb. sample
- c. Moving grain stream: Take a composite 10-lb sample consisting of 12 to 20 subsamples from the grain stream
- d. Keep samples cool, but do not freeze
- e. Ship promptly, early in the week, to avoid weekend delays

3. Analytical methods

- a. Enzyme-linked immunosorbent assay (ELISA)

References

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Table 1. Guidance levels for fumonisin.			
<i>(expressed on 100% dry matter basis)</i>			
Animal type	Guidance level for:		Maximum fraction of corn or corn products in total diet
	Grain, by-products ----- mg/kg or ppm -----	Total diet -----	
Horses	5	1	20%
Breeding ruminants, lactating cattle	30	15	50%
Ruminants for slaughter ≥ 3 months old	60	30	50%
Swine	20	10	50%
Poultry for slaughter	100	50	50%
Poultry for egg-laying	100	50	50%
Poultry, breeding	30	15	50%
Rabbits	5	1	20%
Mink, breeding	30	15	50%
Mink for pelts	60	30	50%
Catfish	20	10	50%
All other livestock, pets	10	5	50%