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Mycotoxin Contamination of Corn Grain and Silage in the Northeast

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Mycotoxins

Mycotoxin is a general term for *a poison produced by a fungus*. Only certain strains of certain fungi produce mycotoxins, and only under certain environmental conditions. Corn and small grain cereals are especially prone to accumulate mycotoxins in their seed tissues, although the stem (stover) fraction of these crops may also be invaded by toxin-producing molds. Molds may continue to grow and produce toxins in stored commodities under aerobic, high moisture conditions. However our most prevalent problems in the Northeast have been with mycotoxins produced in standing crops prior to harvest. Most contamination of corn in the Northeast involves mycotoxins (deoxynivalenol, zearalenone, and fumonisins) produced by fungi in the genus *Fusarium* (also known as *Gibberella*). Mycotoxin problems in wheat and barley in the Northeast have principally involved deoxynivalenol produced by the pink-colored mold *Fusarium graminearum*. Mycotoxins are only problematic when they occur in commodities and feeds above levels of concern established for individual animal species (Table 1). Mycotoxin contamination is measured in parts per million (ppm) and parts per billion (ppb).

Table 1. **Main Mycotoxins Occurring in Corn Produced in the Northeastern United States**

Mycotoxin:	Predominant toxigenic mold:	Lowest level of concern:	Common effects on animals:
Deoxynivalenol (vomitoxin)	*Fusarium graminearum* (*Gibberella zeae*)	1-3 ppm *	Feed refusal in monogastric animals; severity increases with level. Swine and dogs are the most sensitive species; adult cattle and poultry tolerate > 10 ppm.
Zearalenone	*Fusarium graminearum* (*Gibberella zeae*)	1-5 ppm	Hyperestrogenism and infertility. Swine (gilts) are most sensitive; adult cattle tolerate 50 ppm.
Fumonisins	*Fusarium verticilloides; F. proliferatum*	5-10 ppm >100 ppm	Brain deterioration, death (horses); liver damage (horses, swine, cattle, poultry, others). Lung damage in swine

*USDA recommends less than 1 ppm deoxynivalenol in finished food products and less than 2 ppm in unmilled grain destined for human consumption.

Greatest mycotoxin risk factors in corn production:

- Moist weather at silk emergence (Gibberella ear rot; DON and zearalenone)
- Drought, high temperatures during grain maturation (Fusarium and Gibberella stalk rots; Fusarium ear rot; fumonisins)
- Insect or other mechanical damage to ears or stalks
- Delayed maturation/delayed harvest

- Contaminated storage structures
- Failure to adequately dry grain or poor ventilation of dried grain storage
- Failure to exclude air from high moisture, anaerobic storage

Field practices that reduce the risk of mycotoxin contamination in corn:

- Timely planting of locally adapted hybrids of appropriate maturity with partial resistance to Gibberella ear rot
- Avoiding continuous planting of corn under conservation tillage, especially where Gibberella/Fusarium stalk rot is prevalent
- Fertilizing based on soil test and avoiding excessive nitrogen
- Avoiding stress from insects, weeds, and excessively high plant populations
- Planning ahead for harvest and subsequent grain handling:
  - Clean grain bins before putting in the new crop
  - Harvest fields with delayed maturity or high lodging potential as silage or grain for anaerobic storage; or be prepared to rapidly dry grain down to 13.5% moisture content
  - Aerate grain bins to prevent moisture migration caused by colder temperatures
  - Harvest silage at recommended plant maturity, and pack well to eliminate air pockets

Testing for mycotoxins

On-site test or laboratory test?

On-site test kits are available through commercial firms. Most are antibody-based and indicate contamination by a color change; other tests utilize thin layer chromatography (TLC) or minicolumns. On-site tests are quick and relatively inexpensive (depends on the number of samples run). They generally give accurate and reproducible results when used on dry grain samples; they are not as reliable for high moisture grain or silage. Specific mycotoxins can be quantified relative to standards that are supplied with the kits. On-site tests are often used as diagnostic tests prior to confirming laboratory tests.

Commercial and government/university labs offer mycotoxin testing. Lab tests are expensive, comprehensive, and quantitative for many toxins, and are useful for wet and dry samples. Methods include high-pressure liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS).

Sample collection and handling

Samples must be representative of grain in a truck or bin or silo. Obtain many small samples at periodic intervals from a moving stream of grain or by probing all levels and areas of a stationary grain mass to make a composite 10 lb sample, that should be further mixed and subsampled to produce a 2 lb sample for shipping to a lab. Ship dry samples in breathable cloth or stout paper bags. Wet samples should be in sealed containers and be frozen or refrigerated during transit.

More information on on-site tests and/or laboratory analyses is available from:

- Cumberland Valley Analytical Services, Hagerstown, MD. Phone 800-282-7522 (www.foragelab.com)
- Dairy One Forage Lab, Ithaca, NY. Phone 607-257-1272, extension 2172. (www.dairyone.com)
- Neogen Corporation. Phone 800-234-5333 (www.neogen.com)
- Romer Labs, Inc. Phone 636-583-8600 (www.romerlabs.com)
- Trilogy Anlaytical Laboratory. Phone 636-239-1521 (www.trilogylab.com)