Mycotoxins Produced by *Fusarium* Fungi in Corn

- Species of the fungus *Fusarium* cause both Gibberella and Fusarium ear rots of corn; these fungi may also produce several mycotoxins.
- Mycotoxins produced by *Fusarium* can be toxic to animals and cause a variety of symptoms in different types of livestock.
- Accurate grain sampling for testing, proper handling of contaminated grain during harvest, and proper storage are key to limiting further mycotoxin contamination.

### Causal Organisms and Disease Symptoms

*Fusarium* fungi are responsible for causing both Gibberella ear rot and Fusarium ear rot. Gibberella ear rot is caused by the fungus *Fusarium graminearum* (also known as *Gibberella zeae*). Symptoms include reddish kernel discoloration, usually beginning at the ear tip (Figure 1). Husks may rot and become cemented to the ear. Disease development is favored by cool, humid weather, particularly 2 to 3 weeks after silking. In addition to ear rot, this fungus can also cause a corn stalk rot and head scab of small grains. Cases of mycotoxin contamination by this fungus are often associated with delayed harvest or storing high-moisture corn.

Fusarium ear rot is caused by the fungi *Fusarium verticillioides* (formerly known as *Fusarium moniliforme*) and *Fusarium proliferatum*. Typical symptoms include scattered individual kernels or groups of kernels with whitish-pink to lavender fungal growth (Figure 2). Infected kernels may also have a “starburst” pattern of white streaks on the cap of the kernel or along the base. Infections are more frequent on damaged ear tips and kernels with pericarp injuries or insect feeding damage. Development of this disease is favored by dry weather.

### Mycotoxins

Vomitoxin, also known as deoxynivalenol (DON) is one mycotoxin produced by *F. graminearum*. DON belongs to a larger category of mycotoxins called trichothecenes. While severe illness is possible, animals fed contaminated grain more often have non-specific symptoms such as reduced feeding and reduced weight gain. Because DON is an immunosuppressant, animals may become more susceptible to disease. DON is frequently associated with grain that is harvested wet and stored at moderate to warm temperatures. Optimal conditions for the development of DON are temperatures of 70°F to 85°F with grain moisture levels above 20%. Production of DON stops when grain is dried to moisture levels of 15% or lower. Although action levels have not been established, the FDA has advised that DON levels should not exceed 1 part per million (ppm) in finished wheat products destined for human consumption. In addition, advisory levels have been established for grain products intended for animal feed (Table 1). Other trichothecene mycotoxins, such as T-2, are not specifically regulated by the FDA.

*F. graminearum* can also produce the mycotoxin zearalenone, which has estrogenic properties and can interfere with reproductive efficiency. Swine are the most susceptible, but sheep and cattle can also be negatively affected when fed zearalenone contaminated grain. Susceptibility is affected by the gender and age of animals. It has been shown that symptoms gradually disappear when contaminated feed is removed from the diet. Optimal temperatures for the accumulation of zearalenone are 65°F to 85°F. The FDA has not established action levels or guidance levels for zearalenone.

Fumonisins are produced by the fungus *F. verticillioides*. These mycotoxins cause “blind staggers” in horses and other equines and pulmonary edema in swine. It is common for corn seeds and plants to have symptomless infections of *F. verticillioides*. The fungus can

<table>
<thead>
<tr>
<th>Animal</th>
<th>Maximum DON level allowed</th>
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<tbody>
<tr>
<td>Ruminating dairy cattle (&gt; 4 months old)</td>
<td>5 ppm</td>
</tr>
<tr>
<td>Swine</td>
<td>5 ppm; not to exceed 20% of diet</td>
</tr>
<tr>
<td>Ruminating beef and feedlot cattle (&gt; 4 months old)</td>
<td>10 ppm</td>
</tr>
<tr>
<td>Poultry</td>
<td>10 ppm; not to exceed 50% of diet</td>
</tr>
<tr>
<td>All other animals</td>
<td>5 ppm; not to exceed 40% of diet</td>
</tr>
</tbody>
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Management Considerations

Timely harvest and proper storage can help reduce the risk of contamination by mycotoxins produced by *Fusarium* fungi. The longer corn is left in the field after maturity, the higher the risk on mycotoxin contamination. Rotating away from small grains and corn for 2 to 3 years can reduce inoculum levels of *F. graminearum* and thereby minimize the risk of developing Gibberella ear rot and its associated mycotoxins. Tillage to bury infected residue may also be useful.

Production practices that minimize crop stress should also reduce the risk of preharvest development of fumonisins. Corn products grown out of their range of adaptability tend to have higher fumonisin levels; therefore, select corn products that are adapted to local climate and soil conditions. High populations of corn ear-feeding insects may have the potential to increase fumonisin levels. Select corn products from the Genuity® family of traits such as Genuity® SmartStax®, Genuity® VT Double PRO®, and Genuity® VT Triple PRO® and Genuity® SmartStax® RIB Complete®, Genuity® VT Double PRO® RIB Complete®, and Genuity® VT Triple PRO® RIB Complete® corn blends, which provide growers with dual modes of action against corn earworm and broad spectrum control of other Lepidopteran insects. Avoid excessive plant populations and maintain balanced fertility to help avoid plant stress.


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