



**COOPERATIVE EXTENSION**  
**UNIVERSITY OF CALIFORNIA, DAVIS**



## **Did the wet fall weather increase mycotoxin levels of your silage?**

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Much of California's Great Central Valley received uncharacteristically early rain events this year. Our corn crop for silage is seldom rained on and, as a result, levels of mycotoxins in California corn silages are typically low, at least compared to most other parts of the USA, and California dairies are seldom concerned with mycotoxins in their corn silage. However the early rains this year stimulated mold growth in many corn crops prior to harvest, and thus may have increased mycotoxin levels in the resultant corn silage. Should you be concerned?

### *What are mycotoxins?*

Mycotoxins are toxins produced by some molds (fungi) on plants in order to reduce the activity of other molds or bacteria which are on the same crop. There are hundreds of known mycotoxins, all of which are complex chemical structures, although only a few are thought to impact mammals if they are eaten. In addition, as most molds do not produce mycotoxins the visual presence of molds in a silage, or even high assayed levels of mold spores, should not be presumed to mean that mycotoxins are present – although they might be present.

However molds will always, at least to some extent, reduce silage palatability and, as they use the most fermentable parts of the crop, reduce its energy value.

### *Why be concerned about mycotoxins in silage?*

Keep in mind that low levels of mycotoxins are present in most silages under most conditions and cattle frequently consume them in their diets. This is generally not a problem as rumen bacteria are effective in detoxifying mycotoxins in the rumen. However if a diet is very high in mycotoxins, the ability of the bacterial population to effectively detoxify them may be overwhelmed. If this happens, then mycotoxins escape the rumen, are absorbed from the small intestine and exert their toxic effects on the animal. If this happens, common symptoms include:

- reduced feed intake and milk production
  - o off feeds, ketosis and DA's may increase as a result
- diarrhea will occur in many impacted animals
- swollen vulvas and nipples and vaginal or rectal prolapse
- reduced fertility
- increased incidence of early term abortion

#### *What are the most common mycotoxins?*

The mycotoxins found most frequently, and of greatest concern, are aflatoxin (produced by *Aspergillus* molds), zearalenone, T-2 toxin, deoxynivalenol (DON; a.k.a vomitoxin) and fumonisin (produced by *Fusarium* molds) and ochratoxin (produced by *Penicillium* molds). While many others are known to exist their impacts on animals are largely unknown but not considered to be a problem under most situations. Deoxynivalenol (DON; a.k.a vomitoxin) has been considered to be a key mycotoxin as other mycotoxins are seldom found in silages if DON is absent.

These mycotoxin producing molds are always present on crops in the field (which is where they are produced) and so some level of mycotoxins are always in crops which are ensiled. However as mold growth is spurred by wet field conditions, this year may be a bad year for mycotoxins in corn silage.

#### *Which animals are most susceptible to mycotoxins?*

Because of the ability of the rumen bacterial population to detoxify most mycotoxins, cattle are in general less susceptible to mycotoxin toxicity than non-ruminants such as swine, poultry and humans. However 'at risk' cattle classes are pre-ruminant calves with limited rumen function, cows with sub-optimal rumen bacterial populations (such as fresh cows with low intakes) and cows with high ruminal passage rates (such as high producing cows with high intakes because the mycotoxins stay in the rumen for a short time). In addition, breeding (and recently bred) cows are more susceptible to mycotoxin toxicity.

#### *How do I know if my silage has unsafe levels of mycotoxins?*

Visible molds on silages are an indication that mycotoxins may be present. Thus if you see molds you should inform your consulting nutritionist who will take a sample of the suspect silage and send it for analysis. This sample should be from the mixed silage which is actually being added to rations and should be transported to the laboratory quickly since mycotoxins can be produced after sampling in the presence of oxygen. While most of the main mycotoxins listed above can be chemically analyzed, their assay costs are high, although they seldom approach the costs of animal losses if mycotoxin toxicosis occurs.

#### *What are safe dietary levels of mycotoxins?*

Keep in mind that there are no totally safe dietary levels of mycotoxins, but there are levels which are generally considered to be safe. In addition, not all mycotoxins have been investigated sufficiently to create 'safe' levels. Nevertheless, some guidelines are:

<i>Aflatoxin</i>	
At risk cattle	100 ppb
Other cattle	200 ppb
<i>Deoxynivalenol (DON; a.k.a vomitoxin)</i>	
At risk cattle	3 ppm
Other cattle	5 ppm
<i>Fumonisin</i>	
At risk cattle	30 ppm
Other cattle	50 ppm
<i>T-2</i>	
At risk cattle	50 ppb
Other cattle	100 ppb
<i>Zearalenone</i>	
At risk cattle	15 ppm
Other cattle	25 ppm

*What can I do if I have an unsafe level of a mycotoxin in my silage?*

The silage process itself will not detoxify mycotoxins, which are largely produced in the field, as these are very stable compounds. However ensiling will dramatically reduce the activity of the molds, at least if oxygen is unavailable. Thus this would be a good year to practice good silo unloading practices (flat faces, 4 - 6 inch face removal daily, no leftover silage at the end of the day) to prevent molds from growing again once oxygen is available at load out.

Recognize also that the levels listed above are in the total diet dry matter. Thus if you have a corn silage with 500 ppb aflatoxin which is fed at 20% of diet DM, then its contribution to dietary aflatoxin levels is 100 ppb. This leads to the first, and most common, strategy to limit mycotoxin toxicosis, which is to dilute (feed less of) the infected silage in the diet in order to get the calculated mycotoxin level of the diet down to a safe level. If this is impractical or impossible, many dairies in the Northeast have claimed success by feeding 100 to 200 g/cow/day of sodium bentonite (commonly called bentonite, which is a form of clay), which acts by binding the mycotoxins so that they are inactivated and pass harmlessly through the gastrointestinal tract to be expelled in feces. However, as bentonites originate from many sources, and differ in unknown ways, all bentonites are unlikely to be equally effective in general, and may also not be equally effective against all mycotoxins (which may explain why some Northeast dairies have had success with bentonite and some have not). There are also companies which market mycotoxin binders which likely act similar to bentonite but, as commercially produced products, will be more consistent.

*What can I do if I have unsafe levels of several mycotoxins in my silage?*

If you have high levels of more than one mycotoxin in a silage, then you have entered uncharted waters and the guidelines listed above may, or may not, be valid. However, in general, it is recommended that you be conservative with the

guidelines when you have significant levels of more than one mycotoxin, and very conservative indeed if you have several. Keep in mind that deoxynivalenol (DON; a.k.a vomitoxin) has been considered to be a key mycotoxin to assay as other mycotoxins are seldom found in silages if DON is absent.

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