



Mycotoxins are concentrated in distillers grains

THE large expansion of the ethanol industry that occurred since 2005 has expanded the supply of co-products for animal feed. Distillers dried grains with solubles (DDGS) is a major co-product of the fuel-ethanol industry and a frequent ingredient of dairy cattle rations. One potential health risk of ethanol production from corn concerns mycotoxins. Several mycotoxins can be found in corn and corn co-products, including aflatoxins, deoxynivalenol, fumonisins, T-2 toxins, and zearalenone.

In a survey of local dairy producers conducted by the dairy science department at South Dakota State University in 2011, farmers ranked the degree of importance of several distillers grains issues (1 = none, 2 = low, 3 = average, and 4 = high). "Mycotoxin content" was rated with a degree of importance of 3.8.

Several experiments have evaluated the mycotoxin concentration of DDGS from the ethanol fermentation process when mold-contaminated grain is used as a substrate. Findings common to all these experiments were:

- An absence of mycotoxins were found in ethanol.
- Minimum degradation of mycotoxins occurred during the fermentation process.
- Mycotoxin concentration was higher in the co-products than the grain of origin.

The heightened level of a given mycotoxin in DDGS was reported to be approximately three times as high as the level in the grain. Moreover, molds can grow and mycotoxins can be produced in DDGS during transport, storage, and feeding at the farm. Distillers grains are more susceptible to mold colonization than unprocessed kernels because the pericarp that protects the grain has been completely disrupted, which allows for an easier colonization of the remaining nutrients by mold spores.

Dairy cattle are susceptible

Dairy cattle can better resist the adverse health effects associated with mycotoxin exposure because of their ability to degrade mycotoxins in the rumen; however, rumen metabolites of the parent mycotoxin may be equally or exceedingly toxic. In addition, dairy cattle are subjected to greater production stress, which may amplify their susceptibility. Although mycotoxins can be the primary agent causing acute health issues in a dairy herd, they more likely contribute to chronic problems, such as a higher incidence of disease, poor reproductive performance, or suboptimal production.

The limits established for dairy cattle by the U.S. Food and Drug Administration (FDA) for aflatoxin B1, deoxynivalenol, and fumoni-

sin are 20 ppb, 5 ppm, and 30 ppm, respectively. Unfortunately, the FDA has not published maximum concentrations for other mycotoxins with known deleterious effects on cattle such as T-2 (trichothecenes), ochratoxin, or zearalenone.

Although the FDA does not suggest safety guidelines for zearalenone, the European Commission established 250 ppb as the maximum legal limit in complete feed for this mycotoxin. Feeds samples submitted by North Carolina dairy producers over a five-year period indicated high concentrations of mycotoxins occurred frequently in total mixed rations, with vomitoxin, zearalenone, fumonisin, and aflatoxin occurring at 61.4, 30.2, 25.0, and 17.8 percent of positive samples, respectively.

Ethanol plant evaluation

Researchers from the National Corn-to-Ethanol Research Center evaluated DDGS from ethanol plants located in the Midwest. In the first study, they analyzed 182 samples from 20 plants obtained periodically from February 2006 through May 2008. These researchers did not find concentrations of aflatoxin B1, deoxynivalenol, or fumonisin greater than the FDA limits established for dairy cow diets. Toxin T-2 and aflatoxins B2, G1, and G2 were not detected on these samples. In addition, the concentration of zearalenone was below the maximum tolerated by the European Commission.

In a second trial, they evaluated the contamination of DDGS pro-

duced between 2009 and 2011 by eight ethanol plants. In contrast with the previous experiment, in this study the researchers detected samples (12 percent) with deoxynivalenol concentrations above those suggested by the FDA for lactating dairy cows. Although deoxynivalenol was detected in all the samples, those that had concentrations above the FDA limits came from only two ethanol plants. In addition, the authors found that from August 2009 to January 2010, deoxynivalenol concentrations were up in all eight plants. Levels remained constant from March to September 2010 and finally dropped drastically in January 2011.

The authors suggested that the influx in deoxynivalenol concentrations in DDGS between August 2009 and January 2010 might have been the result of the ethanol plants using corn that already contained deoxynivalenol. The weather during 2009 favored the growth of the mold *Fusobacterium graminearum*, which produces this mycotoxin. These data show how important it is for ethanol plants to perform regular mycotoxin monitoring on the corn they utilize as substrate. Their prevention protocols for avoiding contaminated co-products from being sold as livestock feed are equally important.

A closer look on farms

In a study conducted over five years by an animal nutrition company, researchers analyzed the mycotoxin content in 409 DDGS

samples from farms or feed processing plants all over the world. The authors reported that only 2 percent of DDGS samples analyzed had mycotoxin contamination concentrations below the detection limits.

In that experiment, 6 percent of the samples were contaminated with one mycotoxin, while the majority (92 percent) had two or more. The concentration of aflatoxins and deoxynivalenol, however, were higher (2 and 8 percent, respectively) than the limits established by the FDA for dairy cattle. In addition, none of these samples had fumonisin concentrations higher than the established limits.

In a survey conducted by South Dakota State University researchers, 19 samples of distillers grains (13 wet, six dried) from large South Dakota and Minnesota dairy farms were analyzed to evaluate mycotoxin concentrations. Aflatoxin B2 was detected in two distillers grains (dried) samples (10.5 percent of the total) in concentrations greater than those suggested as maximums by the FDA in feedstuffs for lactating dairy cows and for young stock (32.0 and 36.7 ppb). The rest of the samples had no aflatoxins, deoxynivalenol, or fumonisin above the maximum concentration authorized by the agency.

Mold growth and mycotoxin production in corn grain and DDGS depend upon weather conditions and, therefore, may change between years. Feed sample analyses and adequate dietary intervention can prevent the detrimental effects of feed contaminants on dairy cows. 🐄

The author is a dairy nutrition and management consultant.