Corn Quality Challenges Effects on Dairy Cattle; Fall Harvest 2009

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Take Home Messages

- A wet fall combined with cool temperatures means this year's corn crop is at risk for higher than normal amounts of mold, yeast, and some mycotoxins.
- Mycotoxins associated with molds have a greater impact on health and performance of dairy cattle than the mold itself. However, molds and yeast often depress feed intake and animal performance.
- Feeding strategies to minimize the impact of molds, yeasts and mycotoxins in corn and corn silage include:
    - Ruminants can degrade some of the mycotoxins contained in feed. Diluting contaminated feed with good clean forages and grains will help minimize or negate any mycotoxin affects.
    - Focus on quality management of corn silage and high moisture corn in storage. Manage faces of silage, and keep air exposure to feed at a minimum until fed.
    - Manage moisture in bins where dry corn and grains are stored.
    - Test feeds for mold, yeast and mycotoxins. Knowledge gained through analysis will help producers, nutritionists, and veterinarians determine how to best manage and feed low-quality, contaminated feeds.
    - General analysis data from commercial labs on mold, yeast and mycotoxin in feeds is useful, but limited by the quality of the sample that is collected. Don't rely on someone else's test, test your own feeds for these contaminants.
    - Avoid feeding poor quality and contaminated feed to animals that are susceptible to stress including transition cows, high producing cows, and young stock.
    - Monitor all feeds, both homegrown and purchased, for mycotoxins, molds and yeasts.
    - Consider using feed additives that may bind mycotoxins or improve feed intake and digestibility.
    - Ensure micronutrient, vitamin and antioxidant requirements are met or exceeded when feeding out of condition feeds.
    - Optimize management of high moisture corn and other feeds at feeding whether in a TMR or as individual feeds by:
        - Minimizing the time feeds are removed from storage until they are fed.
        - Feed fresh feeds daily or more frequently. Smaller amounts more frequently fed are better than one large amount fed once.
        - Consider adding a TMR saver or propionic acid based preservative to the TMR to prolong bunk life and minimize mold growth.
        - Manage faces of bags, bunkers and even upright silos for maximum feed removal each day, but minimum exposure to air. Close bags and oxygen limiting silos between feedings.

Mycotoxins on the Rise

Record October rainfall and poor drying conditions have increased the risk for mold development in corn throughout the upper Midwest. Molds are filamentous fungi that commonly occur in grain and forages. Feed infected with mold may also contain toxic fungal metabolites called **mycotoxins**. Commercial labs in Wisconsin and Minnesota have analyzed samples containing high mold and yeast counts during the last week of October. Mold or fungi produce toxic compounds (mycotoxins) to assist in developing a more favorable environment for their own survival and growth. Not only does moldy corn have the potential to contain mycotoxins, but it also is reduced in quality characterized by reduced bushel weight and lowered nutrient content.

Moist conditions reduce the corn's natural defense mechanisms against mold and mycotoxin counts in the field and in storage. A few producers in the Upper Midwest have reported that some ears of corn are still hanging upright on the stalk. The leaves around these upright ears may act as a reservoir, trapping moisture around the grain. Weather patterns over the next couple of weeks will be critical in determining the quality of corn that will be harvested in 2009.

Identification of mold

One of the first steps in working this problem may be to get a mold identification analysis. This analysis indicates if a species capable of producing mycotoxins is present. Mold counts in general are not definitive as they can vary a lot from sample to sample and really don't give you any indication of mycotoxin in the feed. In most cases, moldy corn has the potential for mycotoxin contamination. If you get an ID of molds that can produce mycotoxins, then store the feed as best you can and a month later do another ID test to see if the species have changed. If molds are present that produce mycotoxins a month later, consider using binder products in ration, blending feed, other practices, perhaps then doing a mycotoxin ID with ppm levels.

Aspergillus spp. and *Fusarium* spp. produce toxins of most concern, *Penicillium* spp. is intermediate and fungi such as *Diplodia* are generally more benign, especially if grain is generally intact and undamaged physically. Mycotoxins are toxic substances produced by fungi or molds that grow on grain or feed in the field or in storage. Mycotoxins associated with cool and wet conditions are zearalenone, T-2 toxin, fumonisin, and deoxynivalenol, also called DON or vomitoxin.

The following are mycotoxin risk levels for dairy cattle, expressed on a total ration, dry-matter basis.

· DON (vomitoxin); less than 5 to 6 parts per million
· Fumonisin; less than 25 ppm million
· T-2 toxin; less than 100 to 200 parts per billion
· Zearfalenone; less than 300 parts per billion
· Aflatoxin; less than 20 parts per billion

Aflatoxin is the most potent of these mycotoxins and can be toxic to some animals in very low concentrations (< 100 ppb). Generally, aflatoxins are more common after drought and heavy insect pressure. This doesn't seem to be the major issue in Minnesota this year, however be alert to corn with yellow-green light green powdery growth. A 'black-light' test at the elevator is a quick method of determining if aflatoxins are likely – a U.V. light may cause some grains to fluoresce yellow-green, indicating the presence of an acid that is often found along with aflatoxins. The test is only a rough indicator and should not be used to obtain definitive results.

Potential effects of corn mold on dairy cattle

Signs of mycotoxin in dairy cattle include rumen disorders and reduced microbial digestion, loose manure, reduced dry matter intake, decline in fertility, hormonal-like changes such as udder development (estrogenic effects), weight loss, and immune suppression where cattle do not respond to disease challenges. Milk production and milk components may be reduced in some cases. High mold and yeast counts have been associated with hemorrhagic bowel syndrome in dairy cattle, although a direct link remains unclear. Negative health effects to moldy feed may be difficult to diagnose because mycotoxins residues are not easily detected in the cow, symptoms are often nonspecific and may be the result of a series of events or opportunistic diseases. Feeding high energy diets with insufficient dietary fiber (acidotic conditions) may result in greater risk than normal due to reduced fiber digestibility and immune challenges.

Feed Sample Collection and Analysis

The manner in which samples are obtained and processed is an important consideration when testing for aflatoxin and other mycotoxins. Samples of grain must be representative of the lot and of sufficient size to compensate for the uneven distribution of the contaminant as well as the ultralow levels (parts per billion) that must be detected. Variability in grain samples used for mycotoxin analysis occurs because individual kernels do not contain the same amount of the contaminant, not all kernels are contaminated, and their distribution throughout the load may not be uniform. Accurate sampling of all grain needs to be a priority when we are trying to determine if mold and yeast are a problem in feed. Collection of samples from multiple locations throughout a field or shipment or storage container will yield a more accurate picture.

Commercial feed labs can test forages and grains for the presence and concentration of mycotoxins and yeast. Commercial labs require three to four days for analysis of molds and yeasts. Analysis of individual samples range from $70 to $100 per sample and is money well spent to help manage potential problems. Pooling of several samples may be useful to reduce the number of samples analyzed, while at the same time giving a broader picture of the mycotoxins dairy cattle might be exposed to.

We are currently recommending that representative feed samples should be tested for mold and yeast to get baseline measurements as grain is being placed in storage. At feed-out, samples should also be collected to determine if changes have occurred during storage. If grain is properly dried, then mold and yeast counts may not increase during storage. Producers need to be aware of the potential for flare-ups in mold and yeast counts if storage conditions are too wet.

Feeding Management Solutions

Dilution of contaminated feed with clean feed can reduce mycotoxins to acceptable levels, but be forewarned -- contaminated feed can vary greatly in concentration. If you are concerned that mold risks could be a problem, the first recommendation is to test the feed. Tests can be expensive and sampling and feed variation can reduce the usefulness of the results. Adding a mycotoxin binder can reduce the impact of toxins by reducing their impact in the digestive tract and/or not absorbed. Binders include yeast cell wall extracts or MOS products and clay binders. Experiments testing the effectiveness of these products are difficult to conduct, so limited research illustrating effectiveness of binding agents on molds and mycotoxins is limited. Enhance rations with antioxidants such as; vitamin A and E, copper, zinc, manganese, and selenium. Antioxidants promote cow health and may reduce the incidence and severity of health disorders. Mycotoxins may decrease microbial protein synthesis (Danike et al., 2005 and 2006). Feeding additional protein when mycotoxins are known to be a problem may be warranted.

Increased risk of additional mold growth may occur in high moisture corn until the pH of the fermented corn drops (can take several days after ensiling). Adding a grain inoculant to speed up fermentation and stabilize the wet corn is recommended. Shelling high moisture corn is recommended as mycotoxin levels may be highest in the cob. Dry matter recommendations for high moisture corn in bags is 28-30% and 25% in upright oxygen limiting structures. Recommended dry matter for snaplage (whole ear including shucks, cob and grain is usually over 30%, up to 35%, depending on the amount of snaplage that is not grain. Snaplage must be chopped or ground fine enough so that adequate compaction to exclude oxygen can be achieved. Exclusion of oxygen promotes a favorable environment for lactic acid bacterial fermentation resulting in a low pH and stable feed. Propionic acid application at ensiling will help retard additional mold growth before fermentation begans. Typical application amounts are .1 to 1% weight to weight or 2 - 20 lbs per ton. Field evidence suggests that commercial products containing acetic and benzoic acid may help reduce yeast.

Drying corn below 15 percent moisture stops further toxin development. Drying cost are estimated at $0.50/bu to dry corn from 30 to 15% moisture. Producers may seek even lower moisture levels closer to 13% to further reduce risk of mold development in storage. Drying may be help reduce risk by allowing earlier harvest and reducing mold growth in storage.

Dairy cattle that are already under some stress, transition cows and very high producing cows, may be the first to show problem symptoms. Cows that are consuming high amounts of dry matter may be more susceptible to problems with mold and mycotoxin as they are eating more of the potentially contaminated feed and the feed residence time in the rumen is often short due to the high rate of passage. Steers can tolerate higher levels of problematic feed than young animals and pregnant cattle.

Removing fines, damaged seeds, and cracked corn kernels can reduce toxin risk. And the reverse is that, if you purchase corn screenings, you can expect higher levels of mycotoxins.
Also, distillers grain produced from ethanol production can concentrate the level of toxins in the feed. Continuing to emphasize feeding management is an additional tool that may help combat problem feeds. Silage bunker and bag face management, frequent cleaning of feed bunks, remove spoiled feed from silage piles, discard feed refusals, and keeping commodities and baled hay out of the weather are some of the useful ways to manage cows when feed quality is suspect.

The next ten months may offer feeding challenges in the upper Mid-west that we have not experienced in many years. Investments in vigilance and care in procuring quality feeds for dairy cattle will be as important as ever in the upcoming months.