Mycotoxin Madness: Sensible Approaches to a Permanent Problem

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INTRODUCTION

Mycotoxins have plagued the diet of humans and domesticated livestock ever since man began cultivating grains. Historians believe that the fungal ergots in rye and other grains have caused intermittent physical and mental health problems within European populations since the Middle Ages and even the hysteria of the Salem witch trials has been attributed to ergot-related hallucinations and seizures. In recent years, it sometimes feels like the dairy feed business also experiences occasional mycotoxin-related hysteria. Without a doubt, the growing and harvest conditions of the last couple of years have made mycotoxins an almost constant threat in some areas of the Midwest; however, has the mycotoxin problem really become as bad as advertised? That is, has the baseline level of mycotoxins in the feed supply really increased that much over time or has this issue been somewhat blown out of proportion by greater awareness and more sensitive mycotoxin testing technology?

In fact, mycotoxins are a significant problem for the modern dairy cow. However, the increased industry awareness of mycotoxins has probably increased our emphasis on cow health as much as it increased our focus on mycotoxin prevention and treatment per se. Mycotoxicosis and cow immune and digestive health are intimately related and there is a chicken-and-egg aspect to the nature of that relationship. Although mycotoxins do depresses immunity and health, it can also be argued that cows with compromised immunity from other vectors are the ones that are the most susceptible to mycotoxins. Whatever the true relationship, is should be no surprise that herds with erratic feed intake and a suspect feed supply often suffer from the opportunistic diseases that plague immune-suppressed cows. To be successful over the long haul, it is critical that we convince our clients that reducing stress and optimizing herd health are equally as important as any direct mycotoxin intervention strategy when mycotoxins are involved.

There is absolutely nothing easy about detecting, preventing, or managing a mycotoxin challenge. Apparent mycotoxin challenges may come and go, be misdiagnosed or be undetected, making identification of the causative agent ambiguous. Often there is limited flexibility in eliminating contaminated feed sources. In addition, there is usually a limited number of discretionary dollars available for additives and other interventions. With mycotoxin issues, there are many ways to skin the proverbial cat. Below are some overarching concepts that are intended to be instructive or thought-provoking relative to nutritional strategies for developing a comprehensive but practical program for prevention and amelioration of mycotoxin challenges.

Use the threat of mycotoxins to leverage a healthier herd.

As nutritionists, high herd health should really be our ultimate goal and we need our client’s help to achieve that. Some producers are just naturally herd health focused but others only get serious when health threats are more tangible, such as with mycotoxins. Whatever focus area pushes their button, getting a program in place for preventative herd health is money well spent. Feeding for high herd health is cost-effective over the long haul and we must continue to actively promote that. Organic trace minerals and judicious fortification with vitamin E and other immune-related micronutrients are low-cost tools for optimizing immune health. Also, consideration should be given to continuous or at least targeted feeding of immunostimulant materials (glucomannan/β-glucan sources, etc) that have good track records in the field.

The rumen provides some natural defense against mycotoxins – optimize it!

Poor rumen function may exacerbate a mycotoxin challenge in two ways. First, the rumen has a major role in at least partial detoxification of some mycotoxins. For this function to be optimized, we need a robust microbial population and reasonable ruminal resident times for feed components with smaller particle profiles. Secondly, poor rumen function invariably compromises lower intestinal health. The lower GI tract may be the most active immune organ in the body and its roles in innate immunity and as a barrier to pathogens are critical for optimum immune health. Likely, the complex etiology of hemorrhagic bowel is rooted in the negative synergistic effects of a compromised GI tract and mycotoxin presence. Anytime feed intake becomes erratic and the herd appears to be possibly tipping over on a mycotoxin challenge, all
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Anytime I hear a nutritionist say that they do not have mycotoxin problems, I always feel compelled to insert “that we know about” at the end of the sentence. We can probably agree that mycotoxins are always present but, day in and day out, are the levels of individual mycotoxins or alleged “synergistic” effects of multiple mycotoxins serious enough to cause problems? In reality, the science-based understanding of the actual toxicity of individual or multiple mycotoxins in dairy cattle is less than that for monogastric animals. From studies in nonruminant species, however, science has provided clues as to what we should be looking for. Today, the truly useful knowledge of mycotoxin occurrence and management is held, not only by scientists, but by field nutritionists and veterinarians that are focused on this area. In ruminant nutrition, great strides in mycotoxin management have been made in the last decade. The good news is that the new tools for detecting and ameliorating mycotoxins are allowing progress at a much faster pace than ever before. Arguably, mycotoxins are a permanent problem. Nutrition advisers that commit to developing expertise in this area are far more likely to see long-term success in lessening the impact of mycotoxins in their client’s herds.

Take advantage of advanced multi-mycotoxin detection methods.

The reliability of feed sampling will always be the greatest limitation to identifying the source(s) of mycotoxins in the feed. The submitted sample represents 85% of the error in mycotoxin detection; subsampling the ground submitted sample accounts for only 10%; and the analytical procedure error itself accounts for a paltry 5%. The method and cost of mycotoxin analyses can be serious obstacles to on-farm characterization of a mycotoxin challenge. To date, nutritionists have been restricted to requesting analyses for individual mycotoxins or small panels of three or four, usually trying to make educated guesses at which toxins are causing the problem. Lower cost and faster ELISA assays are only qualitative in nature and can give erroneous results due to interferences in some feed matrices. Quantitative assays (TLC), while more diagnostic, are a bit higher in cost.

Recently, a few domestic and off-shore laboratories have begun offering broad-spectrum, multi-mycotoxin analyses at pricing that is beginning to look attractive. These methods offer the opportunity to actually profile the mycotoxin load, including multiple mycotoxins within a class and masked mycotoxins. Almost all routine multi-mycotoxin analyses in food analysis are based on LC-MS/MS (liquid chromatography linked to double mass spec) methodology and will probably replace HPLC as the Gold Standard in the feed industry in the near future. The cost of these analyses generally runs between $250 and $500. Romer Laboratories (http://www.romerlabs.com/en/) is one of the commercial labs that can provide this service in the U.S. Because these analyses are not inexpensive, they are perhaps best used for global profiling of the overall farm feed supply (e.g. testing the TMR) and advanced trouble-shooting. In some ways, multi-mycotoxin analysis can provide an overload of information and we will often not understand the total health implications of “lesser” toxins and apparent cocktails of mycotoxins and metabolites. The very positive upside, however, is that there is no guesswork relative to the types or levels of toxins involved and may explain the severity of a mycotoxicosis when there are low levels of multiple toxins.

Keep struggling with binders and other feed interventions.

A “binder” is the sort of collective term that has come to describe the vast array of clays, zeolites, glucomannans, and other materials that are sold as feed-borne interventions for mycotoxins. This terminology will likely never fade as the majority of products sold on the market today make some claim (stated or implied) that the primary mode of action of their product is to “bind” or “adsorb” mycotoxins, theoretically rendering them inactive in the animal. The scientific literature will clearly support that most clays will bind aflatoxins to greater or lesser extents. However, a claim for “binding” of any other mycotoxin, with any material, is going to be subject to a number of scientific caveats. For example, scientific proof that the mycotoxin remains inactive through the length of the digestive tract is almost never provided. In addition, the critical issue of product feeding rate is rarely dealt with in an unambiguous manner. Dubious product market positioning aside, it is highly likely that most feed-through mycotoxin interventions work at some level; however, the true modes of action may be something other than direct neutralization of mycotoxins. For example, glucomannans may do little more than boost the cow’s immune system, improving her resistance to and recovery from mycotoxins. As nutritionists, it is important that we look past the...
market positioning of binder products and focus on how these products actually perform in the field. The difficulty of resolving mycotoxin challenges cannot be overstated and the contribution of the binder per se is often over-valued. As noted below, the expertise provided by suppliers of mycotoxin interventions is often more important than the interventions themselves.

Mine the knowledge and support of suppliers. As our understanding of mycotoxins in livestock has gradually increased, the quality of mycotoxin products and the technical expertise of the suppliers of these products have advanced dramatically. At least among suppliers that are focused on mycotoxin solutions, there is knowledge and manpower that simply did not exist 10 years ago. Suppliers of mycotoxin solutions are eager to grow their market share and have many marketing tools at their disposal to do so. Due diligence should always be done on any product that is to be used to help assure the health of the dairy herd. Suppliers can enlist the support of outside specialists for trouble-shooting or training and suppliers will sometimes cost-share or defray analytical costs with key customers. Again, we should consider that mycotoxin management is becoming more science than art. To make progress over the long haul, we should focus less on product claims and more on the expertise that a given supplier offers.