



## Leveraging the Animal's Natural Resistance to Mycotoxins

The novel active ingredient in a number of products available to livestock producers today is a fermentation product containing a unique microbial population. Why unique? The fermentation begins with a purposefully-modified, selected *Lactobacillus* strain. At the end of the day, this product offers a field-proven approach to reducing the impact of fungal toxins in production units by enhancing the animal's ability to deal with larger toxin challenges without apparent toxic effects.

Underlying this technology is the modification of the *Lactobacillus* strain to yield an L-form bacterium (see "The L-Form" on p.2). While it will be some time before the mechanism by which this modified bacterium intercedes during mycotoxin challenges is known, those close to the development believe that the ability of L-forms to form close associations with animal cells – in this case the enterocytes of the intestine – may be at the heart of this exceptionally advantageous effect. Modulating GI tract immune function and altering permeability of enterocytes may reduce the net absorption of ingested doses of mycotoxins. For the animal, this means that while a feed test may seem high, the actual dose to the animal is low enough that the natural processes the animal uses to eliminate toxic challenges are adequate to the task. For the producer, this means a realistic strategy to offset feed-borne fungal toxins

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Articles by John A. Doerr, Ph. D.,  
Assistant Dean, Academic Programs,  
College of Agriculture and Natural  
Resources, University of Maryland

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## Mycotoxin Risks in Animal Production

Ask any dairyman. Mold toxins (mycotoxins) are real. They occur most any time of the year and their effects on herd health and performance metrics can be staggering. From the obvious, lowered milk production and estrus problems, to the subtler effects, increased mastitis, lowered disease resistance, weaker offspring, etc., symptoms in the herd result in increased expenses, reduced revenues, and, all too often, lost cows.

Why are mycotoxins such a problem for us? Four factors come to mind that add up to a significant challenge:

- Numbers
- Chemistries
- Distribution/frequency
- Tests

There are at least a dozen genera of molds and more than 100 species that are of importance in animal feeding. You can find more than 350 individual mycotoxins reported from those molds that have varying degrees of toxicity to farm animals. But, more than 2,000 such chemical compounds from molds have been catalogued – how many of those could be added to the 350? So, while we talk about a half dozen important mycotoxins, we have a lot more about which we know very little.

All of these toxins have different chemistries, and, therefore, different actions in the animal. Further, those different chemistries come into play when we try to analyze feedstuffs for them. Finally, the 'persistence' of mycotoxins (their ability to remain unchanged in feedstuffs over time) is also linked to their unique chemistries. Most are quite stable.

From first infection by molds of crops in the field to new toxin synthesis in stored or ensiled feedstuffs, distribution of growing molds and their toxins is not uniform. "Hotspots" is the most often used term describing where mycotoxins are occurring, and 'episodic' best describes when one might find them. Seasonal changes, environmental variables, nature of the feedstuff, etc. all affect which mycotoxins may occur and when. All we can count on is that they are often not where we would expect them to be. Forecasting

episodes of mycotoxin challenge has not proved particularly useful. And finally, we are limited in the kinds of tests we may do to identify which toxins are affecting a particular farm or feedstuff. Rapid tests may not always provide the accuracy we want or, sometimes, the precision we need. Tests which are more accurate and/or precise also require more time, are more labor-intensive, and come at a higher cost. Therefore, we screen for only a relatively few mycotoxins, used as 'marker' toxins, to provide a broad overview of potential toxin challenges.

So, the bottom line is that a producer who tries to define an action plan for mycotoxins based on the premise that he will have accurate, timely, and complete mycotoxin tests may become confused. He is outclassed by the sheer numbers of toxins, their unique chemical compositions, their non-uniform distribution, and the lack of practical tests to cover all of the toxins that we think are most important! The combination of 'marker' mycotoxins screened through practical tests, along with the 'bio assay' (the animals' responses), is the best way for producers to plan action steps to offset mycotoxin challenges to their animals.

To further confound the problem, most research has concentrated on providing descriptive toxicology for individual mycotoxins – one toxin given to one species under highly controlled conditions. Dairy cows aren't presented with mycotoxins in that way. They get a mix of different toxins. The profile of toxins changes continuously, amounts of individual toxins change, and other factors in the day-to-day life of the cow impact how those mycotoxins affect the animal. The symptoms and effects the farmer, nutritionist, veterinarian, etc. see in those animals are likely to be very different from the text-book descriptions of those individual mycotoxin effects.

Producers need solutions that are independent of that elusive 'certain' knowledge of exact mycotoxins and doses. That may mean thinking a little out of the conventional mycotoxin wisdom box! ❀

## L-Form Bacteria

Older bacteriologists recall the heydays of PPLO – pleuro-pneumonia-like-organisms, which were popular subjects of research. Dr. Emilie Kleiberger had fled Nazi Germany to work in the Lister Institute in Britain. She joined others who believed that modifying some pathogenic bacteria to be more like those PPLO types would make disease research more productive. Her isolates of modified *Streptobacillus moniliformis* were labeled L-1, L-2, etc. for Lister isolate 1, etc. The modification? She was changing the ability of the bacterium to produce its cell wall. And, after Dr. Kleiberger's isolates, the descriptor, "L-Form", began being applied to those organisms which had been induced to lose some or all of their cell walls.

All bacteria have cell walls. Some have thicker walls than others. The classical Gram stain, familiar to every student taking a first course in microbiology, differentiates between two kinds of bacteria based on cell wall thickness and composition. A blue stain is applied followed by a chemical wash, and then a red counter-stain. Gram positive bacteria take up the blue stain and hold it. The lighter counter-stain cannot be seen and so these organisms appear purple or blue under the microscope. *Lactobacillus delbrueckii* subsp. *bulgaricus*, commonly found in yoghurt, is an example of a Gram positive bacterium that is beneficial. But bacteria with very thin cell walls lose the primary blue stain and appear pink because of the counter-stain. These are Gram negative. *E. coli* and *Salmonella typhimurium* are examples. L-forms are more properly called cell-wall deficient (CWD) bacteria. The change in cell wall may be sponta-

neous or induced. There are many ways microbiologists may induce CWD states. In the lab, the resulting cell is generally fairly fragile and requires specialized cultural conditions to survive. But in nature, CWD bacteria have been found in some very strange places such as living plant (Paton, A.M. (1987). Presidential Address – L-forms: Evolution or Revolution? *J. Appl. Bacteriol.* 63:365-371) and animal cells (Kita, E. et al., 1995. Conversion of *Salmonella typhimurium* to L-forms contributes to the maintenance of acquired immunity against murine typhoid. *Immunology* 86:206-211)!

While the original work of the Lister Institute is no longer pursued, the amount of research involving CWD bacteria has increased dramatically over the past decade or so. More and more, scientists are finding "unculturable" organisms in odd environments and much is being done to determine the underlying mechanisms and functions of these no-longer-so-novel bacteria. What purpose might nature have in mind to have a small unicellular organism 'shed' its protective cell wall?

While we don't have all the answers yet, it is clear that elimination of cell wall and capacity to inhabit a living plant or animal cell must be of value to the organism. Our interest now is in what 'side' effects may occur, and, specifically, if such effects might be beneficial! For now, however, it is just important to recognize that L-forms exist, that they survive and thrive in circumstances and environments that would seem totally inhospitable from the perspective of a laboratory microbiologist, and that they are able to interact very intimately with the cells of

higher organisms. So, our current task remains to find those conditions under which an L-form might be of advantage to the health and well-being of our livestock. ❀

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and an approach that is relatively independent of the type of fungal toxin present.

Field results over the past fifteen-plus years indicate that these products are efficacious in real life mycotoxin challenges involving four, five or more different mycotoxins. For example, a typical dairy herd may face forages and supplements delivering DON, diacetoxyscirpenol, fumonisins, zearalenone, aflatoxin, and more. Yet health and production parameters can be maintained at normal levels through the use of these unique supplements.

Producers should keep in mind that these products are fermentation-based and contain special L-form bacteria; they are NOT binders or sequestering agents.

Interested in learning more about such products and where they may be obtained? Contact Agrarian Marketing Corporation® at (888) 254-1482, or e-mail at [amc801@aol.com](mailto:amc801@aol.com). ❀

## Sometimes the signs just aren't this obvious.



Mycotoxins are a growing concern among dairy producers. These poisons, produced from field or storage mold growth, affect reproductive, immune and digestive functions of the dairy cow. But, the signs that you have a mycotoxin problem aren't always obvious.

That's why Select Sires is proud to offer an entire line of nutritional supplements, including *Select BIOCYCLE™ Plus*. These products are specifically designed to assist the cow when challenged by mycotoxins. To determine if your herd may be suffering from mycotoxins, contact your Select Sires representative.

*Another Reproductive Solution from Select Sires!*



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Fax: (614) 873-5751  
[www.selectsires.com](http://www.selectsires.com)

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