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**AT THE FEED BUNK WITH JANET:
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**Mold and Mycotoxins in Dairy Cow
Nutrition**

Molds and Mycotoxins in Dairy Cow Nutrition

Weather conditions during growing and harvesting seasons may appreciably increase the incidence and degree of moldy feed and mycotoxin problems from year to year.

- **Fusarium toxins are more likely to occur under cool, wet conditions during growth, harvesting, and storage.**
- **Hot, humid conditions favor the development of aflatoxins.**



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Molds and Mycotoxins in Dairy Cows

- **Delaying harvest to increase maturity and reduce moisture levels, or to avoid muddy field conditions, may result in increased mold growth and mycotoxin formation.**
- **Storing grains, feedstuffs, and forages at moisture levels beyond recommended ranges or in poor storage units also may increase mold-related problems.**



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Molds



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Molds

Moldy or musty feed won't always contain mycotoxins, but the presence of considerable mold in itself may adversely affect production and health.

Molds can have detrimental affects in cows when the immune system is suppressed during stressful periods. The effect of high mold loads can occur in locations such as the lungs, mammary gland, uterus, or intestine (an intestinal infection may result in hemorrhagic bowel).



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Molds

Reductions in production performance and increases in health problems from moldy feed are often moderate even if mycotoxins are not present.

In the field I have seen feed lot animals stop eating completely with disastrous results because of high mold load in high moisture corn. In addition the animals' mouths and eyes were greatly inflamed from the mold.



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Mycotoxins

Under some conditions, molds may produce potent mycotoxins at levels that may adversely affect animal production and health such as higher incidence of disease, poor reproductive performance, or suboptimal milk production.

There also is a potential public health concern when milk contain a level of aflatoxin.

The effects of mycotoxins are cumulative over a period of time and the presence of more than one mycotoxin may increase these effects.



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Mycotoxins

Chronic effects are more often noted than acute, sudden ones; often animals do not die or show acute signs early when exposed to mycotoxins.

It may take several days to several weeks to cause marked changes in performance or acute symptoms.

Ruminal degradation of mycotoxins helps to protect the cow against acute toxicity but may contribute to chronic problems, associated with long-term consumption of low levels of mycotoxins.



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Mycotoxins

Mycotoxins may develop in almost any feedstuff during the growing season, at harvest, or during storage.

While grains receive the most attention, by-product feeds, protein concentrates, finished feeds, oilseeds, wet brewers grains, food wastes, and forages may also contain mycotoxins.

Whole-plant corn silage and haylage are more likely to be contaminated than hays.

Heat-processing and ensiling do not destroy mycotoxins.



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Mycotoxins

It is important to note that signs of mycotoxin toxicity mimic those of other metabolic and infectious diseases.

- ✓ **Reduced intake or feed refusal**
- ✓ Reduced nutrient absorption and impaired metabolism
- ✓ **Altered endocrine and exocrine systems**
- ✓ Suppressed immune function
- ✓ **Altered microbial growth**



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Individual Mycotoxins: Aflatoxins

Aflatoxins are extremely toxic, mutagenic, and carcinogenic compounds produced.

Symptoms of acute aflatoxin toxicity include loss of appetite, lethargy, loss of muscle control, rough hair coat, and pale, enlarged fatty livers.

Symptoms of chronic aflatoxin exposure include reduced feed efficiency and milk production, jaundice, and decreased appetite

Action levels for total aflatoxins in dairy feed 20 pbb (parts per billion).



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Individual Mycotoxins: DON

Deoxynivalenol (DON) or Vomitoxin is commonly detected in feed. It is sometimes called vomitoxin because it was associated with vomiting in swine.

The impact of DON on dairy cattle is not established, but there is an association between DON and poor performance in dairy herds.

Advisory levels for DON levels in grain and grain by-products 5 ppm and finished feeds 2 ppm.



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Individual Mycotoxins: T-2

T-2 toxin is a very potent mycotoxin that occurs in a low proportion of feed samples.

In dairy cattle, T-2 has been associated with gastroenteritis and intestinal hemorrhages.

Guidelines for T-2 toxin are not established, but avoiding levels above 100 ppb may be reasonable.



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Individual Mycotoxins: Zearalenone

Zearalenone is a mycotoxin that has a chemical structure similar to estrogen and can produce an estrogenic response in cows. Zearalenone is associated with ear and stalk rots in corn and with scab in wheat.

Herds with fertility issues should look for zearalenone in feed, however there are currently no established guidelines for zearalenone in feed.



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Individual Mycotoxins: Fumonsisin

Fumonsisin is much less potent in ruminants than in hogs, but it is toxic in ruminants. Because of greater production stress, dairy cattle may be more sensitive to fumonisin than are beef cattle.

Fumonsisin is thought to cause liver damage and reduced milk production caused by reduced feed consumption.

For breeding cow, corn and corn by-products should not exceed 50% of the total dry matter intake and Fumonisin levels should not exceed 30 ppm.



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Individual Mycotoxins: Ergot alkaloids

One of the earliest recognized mycotoxicoses is ergotism caused by a group of ergot alkaloids. They infect the plant and produce toxins in fungal bodies called ergots, which are small black bodies similar in size to the grain.

Ergotism primarily causes nervous condition in animals. Symptoms are directly related to dietary concentrations and include reduced weight gains, lameness, lower milk production, reproductive disorders and immune suppression.



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Individual Mycotoxins: Ochratoxin A (OTA)

In cattle, OTA is rapidly degraded in the rumen and thus thought to be of little consequence unless consumed by young pre-ruminant calves.

Moldy alfalfa hay has been implicated with abortions in cattle and also with cattle deaths.

There are no established guidelines for ochratoxin in feed, so any contamination issue is dealt with on a case-by-case basis.



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Individual Mycotoxins: PR toxin

PR toxin is one of the several mycotoxins produced by *Penicillium* molds. *Penicillium* grows at a low pH and in cool, damp conditions and has been found to be a major contaminant of silage. PR toxin, is thought to be the causative agent associated with moldy corn silage problems.

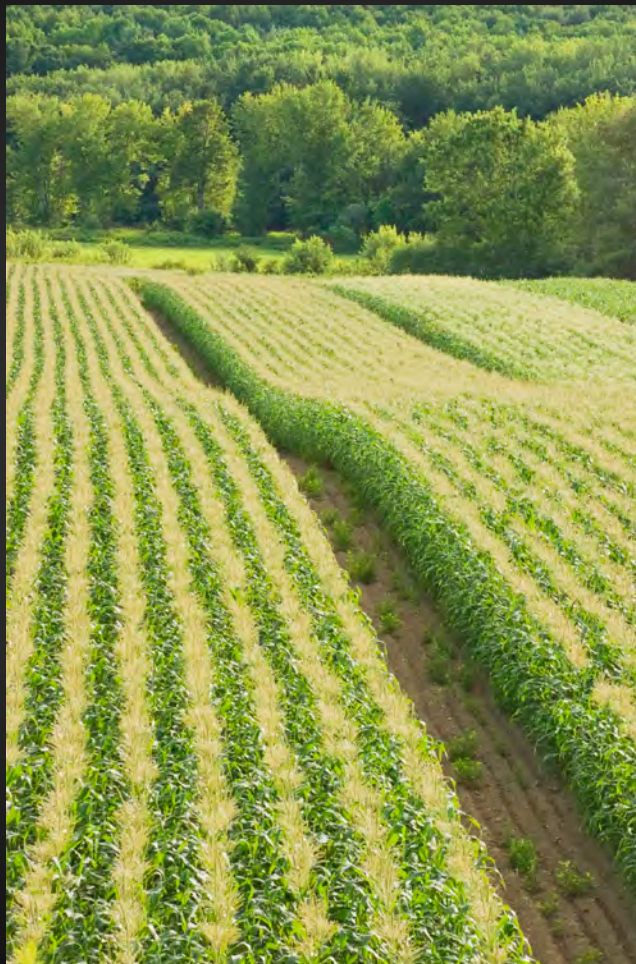
PR toxins in silages, are thought to be associated with herd health problems.



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Individual Mycotoxins: PR toxin



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Individual Mycotoxins: Patulin

Patulin is also produced by *Penicillium* molds.

Patulin is most likely to occur in moldy fruits such as apples but may also be found in grains, especially wet grains, and silage.

In the rumen patulin reduced VFA production, fiber digestion, and bacterial yield however the potential for patulin toxicity of livestock is thought to be low.



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Mycotoxin Testing



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Mycotoxin Testing

Testing for mycotoxins should be considered when signs of potential effects on performance and health exist and cannot be readily explained.

This is particularly important when moldy feeds are being fed or when marked changes in production or health have occurred among a relatively large proportion of animals.



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Mycotoxin Testing

Analytical techniques for mycotoxins are improving. Several commercial laboratories are available and provide screens for an array of mycotoxins.

Cost of analyses has been a constraint but can be insignificant compared with the economic consequences of production and health losses related to mycotoxin contamination; also newer immunoassays have reduced the cost of analyses.



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Mycotoxin Testing

Collection of representative feed samples is a problem because molds can produce large amounts of mycotoxins in small areas, making the mycotoxin concentrations highly variable within the lot of feed.

Because mycotoxins can form in the collected sample, samples should be preserved and delivered to the lab quickly. Samples can be dried, frozen, or treated with a mold inhibitor before shipping.



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Mycotoxin Testing

Sample all moldy and non-moldy feeds that are likely to contain mycotoxins; start by testing TMRs.

If mycotoxins are found in the TMR, ingredients within them should also be tested.

It is important to take representative samples since mycotoxins are present in such small quantities and may only occur in isolated spots in a bin or silo. The mycotoxin content is not necessarily related to the amount of mold seen.



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Types of Test

Basically, two major types of mycotoxin tests are available:

1. Quick tests
2. Confirmatory or quantitative tests.

Many laboratories doing confirmatory tests may initially run quick tests to determine whether the samples are positive and need further quantitative testing.



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Prevention

Prevention of mycotoxin formation is essential since there are few ways to completely overcome problems once mycotoxins are present:

- ✓ **Drought and insect damage are most important in instigating mold growth and mycotoxin formation in the field. Varieties with resistance to fungal disease or to insect damage have fewer field-produced mycotoxins.**
- ✓ **When harvesting, avoid lodged or fallen material because contact with soil can increase mycotoxins.**



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Prevention

- ✓ Mycotoxins increase with delayed harvest and with late season rain and cool periods.
- ✓ **Damaged grains have increased mycotoxin levels; harvesting equipment should be maintained to avoid kernel damage.**
- ✓ Mycotoxin concentrations are greatest in the fines and in broken and damaged kernels; cleaning can greatly reduce mycotoxin concentrations in the feedstuff.



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Prevention

- ✓ After harvest, grains should not be allowed to remain at moisture levels greater than 15 to 18%.
- ✓ High temperatures increase the amount of free moisture in the grain which is the primary cause of mold growth in storage. Storage should be sufficient to eliminate moisture migration, moisture condensation, or leaks.
- ✓ Grain stored for more than two weeks should be kept aerated and cool.



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Prevention

Prevention of mycotoxins in silage includes following accepted silage-making practices aimed at preventing deterioration primarily by quickly reducing pH and eliminating the oxygen:

- ✓ **Harvesting at the proper moisture content**
- ✓ Chopping uniformly at the proper length
- ✓ **Filling the silo rapidly**
- ✓ Packing the silage sufficiently to exclude air
- ✓ **Using an effective fermentation aid**
- ✓ **Covering completely and well**



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Prevention



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Treatment

Action should be taken when signs of possible moldy feed or mycotoxin problems exist.

Improvements in production, performance, and health often occur within three to seven days to several weeks after offending feeds are removed from the ration or their intakes severely reduced, and recommended feed additives are used to bind mycotoxins that may be present.



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Treatment

- ✓ Eliminate other possible causes as soon as feasible with the help of experienced nutritionists, veterinarians, and other trained consultants.
- ✓ Properly adjust energy contents of any moldy feeds or lightweight grains in the ration.
- ✓ Clean moldy grains and remove fines from whole grains suspected of having mycotoxins.
- ✓ Adding mycotoxin binders to contaminated diets has been considered the most promising dietary approach to reduce effects of mycotoxins.



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Treatment

- ✓ Test the ration or most of its components for mycotoxins.
- ✓ Consider testing to help eliminate other possible causes of the adverse effects. Other tests on feed, disease testing via feces, blood, and possibly metabolic profiling may be necessary.
- ✓ Discontinue or severely restrict use of obviously moldy feed or suspected non-moldy feed pending test reports.



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Treatment

Animals a few weeks to several months of age are more susceptible to mold and mycotoxin problems.

Likewise, animals close to parturition or in early lactation are more sensitive to mold and mycotoxins.

Therefore, if contaminated feed must be used, feed it to older replacement cattle and dairy cows in late lactation.



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Treatment



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