Feed Molds & Mycotoxins

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**Terminology**

- **Myco**: Mold, Fungi
- **Mold, Fungi**: Mycology

**Toxin**

- **Poison**

**Mycotoxiosis**

- **Acute or Chronic Disease**
- **via Mold Fungi**

**Mycotoxins e.g.**

- **Aflatoxin**
- **Deoxynivalenol**
- **Zearalenone**
- **Ergot**
- **Fumonisn**
- **Slaframine**

* Note 300-500 known mycotoxins
Feed Mold/Mycotoxin Quiz……..

(True or False)

1. Feeds that are visibly moldy are at high risk for mycotoxin contamination?

2. Feeds that contain no visible mold are seldom contaminated with mycotoxins?

3. Silage that heats during feedout has a high risk of mycotoxin contamination?

4. Knowing the species of mold is a good indicator of mycotoxin contamination potential?

5. The color of molds on crops is a good indicator of mycotoxin contamination potential?

6. Molds that do not produce mycotoxins are harmless to dairy cattle?
Feed Mold/Mycotoxin Quiz…….

(True or False)

1. Feeds that are visibly moldy are at high risk for mycotoxin contamination?  **False**

2. Feeds that contain no visible mold are seldom contaminated with mycotoxins?  **False**

3. Silage that heats during feedout has a high risk of mycotoxin contamination?  **False**

4. Knowing the species of mold is a good indicator of mycotoxin contamination potential?  **False**

5. The color of molds on crops is a good indicator of mycotoxin contamination potential?  **False**

6. Molds that do not produce mycotoxins are harmless to dairy cattle?  **False**
<table>
<thead>
<tr>
<th>Genus</th>
<th>Conditions</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Mucor</em></td>
<td>Storage</td>
<td>Very common, silages, HMC, low O2 needed</td>
</tr>
<tr>
<td><em>Cladosporium</em></td>
<td>Field</td>
<td>Corn after frost</td>
</tr>
<tr>
<td><em>Epicoccum</em></td>
<td>Field/Storage</td>
<td>Common</td>
</tr>
<tr>
<td><em>Nigrospora</em></td>
<td>Field</td>
<td>Ear Rot</td>
</tr>
<tr>
<td><em>Ostilago</em></td>
<td>Field</td>
<td>Smut</td>
</tr>
<tr>
<td><em>Rhizopus</em></td>
<td>Storage</td>
<td>Decay Mold</td>
</tr>
<tr>
<td><em>Yeast</em></td>
<td>Storage</td>
<td>Very common, fast, rapid heating, feed energy reduction</td>
</tr>
</tbody>
</table>
Moldy Feed ….. No Mycotoxins

- Hoffman et al 1995
- Moldy HMC
- Exposed to Oxygen
- Aerobically Unstable
- Fed to Lactating Cows 14 d
- TMR
- No Intake Depression

\[ R^2 = 0.63 \]

Milk Yield lbs/d vs. Mold log 10 cfu
Moldy Feed …… No Mycotoxins

Yeast

- *Cryptococcus*  Non fermenter
- *Rhadotorala*  Non fermenter
- *Sporabolomyces*  Non fermenter
- *Sacchomyces*  Ferments Sugars
- *Candida*  Lactic Acid
- *Hansula*  Lactic Acid

- Endemic Populations
- Explosive Growth Potential 1-3 days
- Low Oxygen Req for Growth
- Require > 60 F for Rapid Growth
- Cause Heating
- Increase pH at Silo Surface
- Reduce DMI?
- Parasitic Effect on Feed Energy
- Chronic Milk Loss
Kung et al 1998

- Corn Silage
- Aerobic Stability Study

Effect of Yeast on Aerobic Stability of Corn Silage

![Graph showing the effect of yeast on aerobic stability of corn silage. The graph plots yeast cfu/d log 10 on the x-axis and aerobic stability hrs on the y-axis. The data points are shown as red circles, and the line of best fit has an R^2 value of 0.85.](image)

R^2 = 0.85
Kung et al 1998 (Organic Acid Stabilization)
- Corn Silage
- Aerobic Stability Study
- LIR Organic Acids (4 lbs/ton)

**Bunklife hrs**

Control Buffered Acids

**Yeast cfu/g log 10**

Control Buffered Acids

### What is presented in the diagrams:

1. **Bunklife hrs**:
   - The diagram compares the bunklife hours between a control and buffered acids treatment. The buffered acids show a significantly higher bunklife compared to the control.

2. **Yeast cfu/g log 10**:
   - The diagram compares the yeast count between a control and buffered acids treatment. The buffered acids treatment has a higher yeast count than the control.

### Observations:

- The buffered acids treatment demonstrates improved aerobic stability as indicated by the increased bunklife hours and yeast count.

### Conclusion:

The use of LIR Organic Acids (4 lbs/ton) is effective in improving the aerobic stability of corn silage, as evidenced by the extended bunklife and higher yeast count in the buffered acids treatment.
## Common Mycotoxins

<table>
<thead>
<tr>
<th>Genus</th>
<th>Mycotoxin</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusarium</td>
<td>DON (Vomitoxin)</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>Fumonisin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HT-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zearalenone</td>
<td></td>
</tr>
<tr>
<td>Aspergillus</td>
<td>Aflatoxin</td>
<td>High Temps</td>
</tr>
<tr>
<td>Penicillium</td>
<td>PR Toxin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citrinin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ochratoxin</td>
<td></td>
</tr>
<tr>
<td>Claviceps</td>
<td>Ergot</td>
<td>Small Grains</td>
</tr>
</tbody>
</table>

- Typically invade corn and small grains
- Fusarium toxins are most common
- Perennial forages (silages) have very low incidence
Mycotoxins (DON-Vomitoxin)

- Normal Corn Silage 1998, 1999
- Levels = 1-4 ppm
- Excellent Growing Conditions
- Testing Labs Credible
- Presence Verified 1998, 1999

Courtesy of Nutrition Professionals, 1999

<table>
<thead>
<tr>
<th>Location</th>
<th>DON Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fond du Lac</td>
<td>1.7 ppm</td>
</tr>
<tr>
<td>Fond du Lac</td>
<td>13.8 ppm</td>
</tr>
<tr>
<td>Fond du Lac</td>
<td>5.8 ppm</td>
</tr>
<tr>
<td>Winnebago</td>
<td>3.0 ppm</td>
</tr>
<tr>
<td>Calumet</td>
<td>5.2 ppm</td>
</tr>
<tr>
<td>Brown</td>
<td>6.2 ppm</td>
</tr>
</tbody>
</table>

Why?

- Field History
- Insect Damage (Corn Borer)
- Leaf Disease
- Susceptible Varieties
Mycotoxins (DON-Vomitoxin)

Question…. Is vomitoxin a serious problem in dairy cattle?

North Carolina State University

Milk Losses Associated with Vomitoxin Contamination. Whitlow et al...
Mycotoxins (DON-Vomitoxin)

Question…. Is vomitoxin a serious problem in dairy cattle?

Vomitoxin is “very” common in Corn Silage

<table>
<thead>
<tr>
<th>Lab</th>
<th>% Corn Silage &gt; 1 ppm (Vomitoxin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairyland</td>
<td>46.0 %</td>
</tr>
<tr>
<td>North Carolina</td>
<td>75.0 % *</td>
</tr>
<tr>
<td>North Dakota</td>
<td>40.0 %</td>
</tr>
</tbody>
</table>

* > 40 ppb of DON
Mycotoxins (DON-Vomitoxin)

Question…. Is vomitoxin a serious problem in dairy cattle?

<table>
<thead>
<tr>
<th>Trial</th>
<th>Animals</th>
<th>Dietary DON ppm</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Lactating</td>
<td>6.4</td>
<td>no effect</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Lactating</td>
<td>8.4</td>
<td>no effect</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Steers</td>
<td>18.0</td>
<td>no effect</td>
</tr>
<tr>
<td>North Dakota</td>
<td>Steers</td>
<td>12.0</td>
<td>no effect</td>
</tr>
<tr>
<td>North Dakota</td>
<td>Beef Heifers</td>
<td>10.0</td>
<td>no effect</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Ewes</td>
<td>12.0</td>
<td>no effect</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Ewes</td>
<td>7.0</td>
<td>no effect</td>
</tr>
</tbody>
</table>
Mycotoxiosis...... Dairy Cattle

- Chronic or Acute
- Herd Problem (Not Individual Animals)
- Mimics other Disease

- Unthrifty Appearance etc
- Milk Loss
- Diminished Reproductive Performance
- Reduced Intake
- Depressed Immune Function
- Lesions
- Diarrhea
Mycotoxin Binding Agents

- Bentonite (Clays)
- Aluminosilicates
- Yeast Cell Wall
- L-Form Bacteria

- Limited Data
- Vague Claims
- Positive Field Experience
- Do not Universally Bind All Mycotoxins

<table>
<thead>
<tr>
<th>Alumniosilicate Binding Capacity</th>
<th>Product A</th>
<th>Product B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aflatoxin</td>
<td>100</td>
<td>89</td>
</tr>
<tr>
<td>DON</td>
<td>3</td>
<td>14</td>
</tr>
</tbody>
</table>

% Mycotoxin absorbed in aqueous solution
Practical Approaches

Mold Yeast Prevention

- Maintain Excellent Feed Preservation Practices
- Use Inoculants when Appropriate
- Consider Organic Acid Stabilizers

Mycotoxin Management

- Observe Herd Performance
- Note Sudden Changes in Herd Performance
- Evaluate All Possible Causes
- Test Feeds for Mycotoxins
  * Use Labs that Specialize in Mycotoxins
  * Test for Multiple Mycotoxins
- If Mycotoxins are Suspected
  * Try a Binding Agent
  * Dilute Diet
  * Monitor Animal Performance
  * Discard Feed