2009 HARVEST ISSUES AND INFORMATION

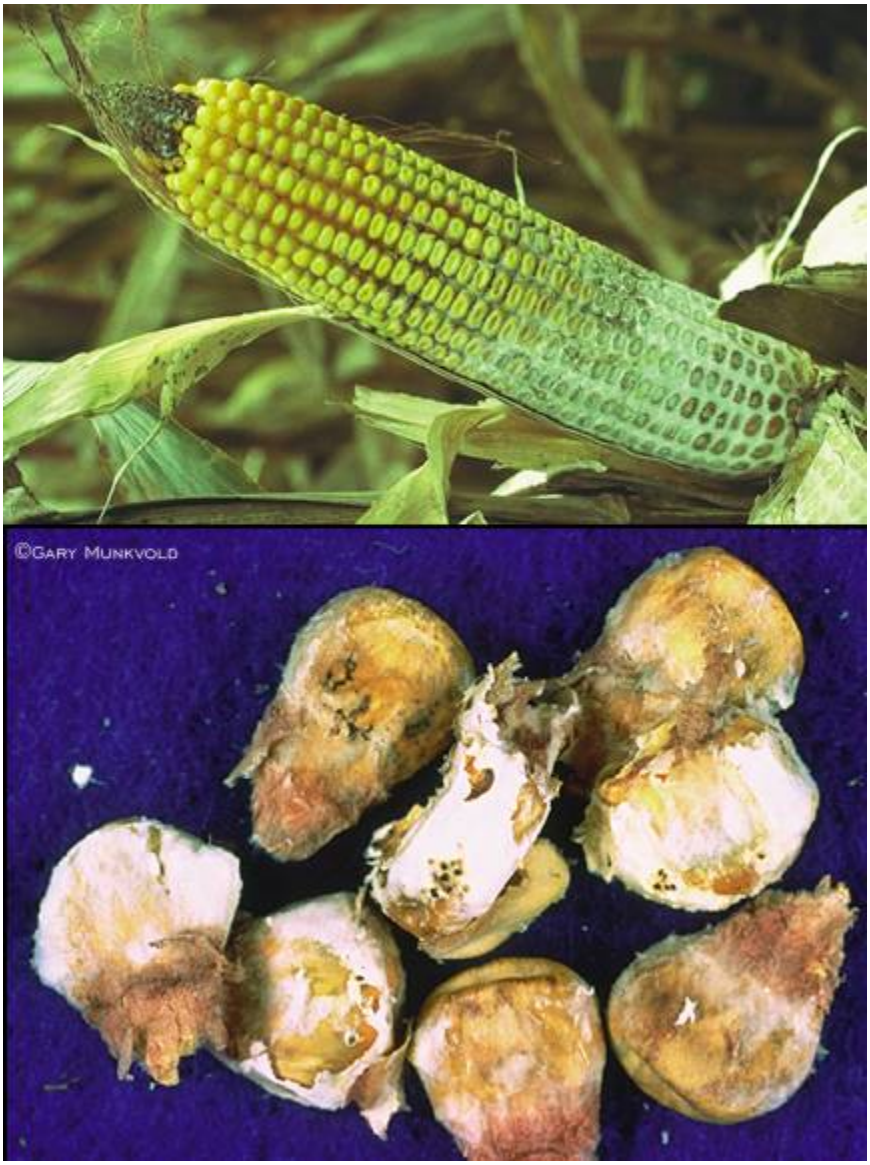
As you have noticed, 2009 is presenting corn producers with various challenges regarding the harvest, storage, and feeding of their crop. The combination of dry and cool summer conditions along with wet and cool fall conditions has resulted in corn moistures remaining high in fields. The extended periods of moist conditions this fall have produced a favorable environment for the growth and development of mold and mycotoxins in corn. This paper was written by Dairyland Seed Company to serve as a source of information for producers who are concerned about their crop. The content is a summarization of published university information from various institutions throughout the Midwest. Dairyland Seed Company will not be held responsible for any negative results attained from using information provided in this document.

Ear Rot Identification

Fusarium ear rot

- Most common mold
- White to pink cottony mold
- Infected kernels are scattered around the cob among healthy-looking kernels
- Infected kernels have white streaks, in a starburst appearance, on the surface
- Insect-damaged kernels are particularly prone to infection
- Can produce mycotoxins (fumonisins)

Diplodia ear rot



- Dense, white mold
- Starts from the base of the ear. Becomes grayish-brown and spreads over the husks and kernels
- Raised black fruiting bodies of the fungus can be seen late in the season
- Favored by wet weather just after silking. More severe when corn is planted after corn.
- Does *not* produce toxins

Gibberella ear rot

- White to pink mold
- Starts at the tip of the ear and grows toward the ear base
- Common in cool, wet weather from silking to harvest
- Can produce mycotoxins (vomitoxin and zearalenone)

Cladosporium kernel rot

- Gray to black or very dark green mold
- Causes black streaks in the kernels
- Insect-, hail-, or frost-damaged kernels are prone to infection
- May cause toxins in feed

Aspergillus ear rot

- Gray-green, powdery mold
- Starts at the tip of the ear or follows insect tracks
- Occurs in hot, dry years
- Can produce mycotoxins (aflatoxin)

Penicillium ear rot

- Blue – green color
- Starts at tip through exposed tip or insect feeding
- Most common in high moisture corn or wet grain corn
- Can cause storage issues
- May cause toxins in feed

Above information provided by Iowa State University

Harvest and Dry Down

Combine Considerations for a Wet Corn Harvest

Matthew Digman
Assistant Professor and Machinery Systems Extension Specialist
UW - Madison

Adjusted properly, your combine can handle corn between 20 and 30% moisture. However, as moistures exceed 30%, your work will be a balancing act between leaving unthreshed grain in the field and grain damage. Here are a few tips to help guide you along in this wet harvest season.

Ground Speed

The first consideration when it comes to harvesting wet corn is ground speed. Be sure to select a ground speed that does not overload your machine as the engine must be able to maintain its rated engine speed to keep separator and cleaning shoe at full speed. Adjust your hydrostatic transmission to maintain the engine near rated speed under varying crop conditions.

Header

The usual advice for minimizing trash input into the combine by operating the header as high as possible is even more critical in these wet conditions. Introducing tough, wet leaf and stalk material into the combine reduces its effectiveness to thresh and separate the grain. Wet stalks and leaves absorb threshing energy that would normally be used to separate grain from cobs. Additionally, this wet mat of material can overwhelm the separator, trapping both threshed and unthreshed grain. Consequently, you may need to consider operating the stripper (deck) plates wider to minimize leaf and stalk material entering the combine. However, be careful to avoid shelling the butt end of the ear with the stripper plates too wide.

Concave

Before changing concave clearance, first make sure it is level side-to-side (conventional combine) or front-to-back (rotary combine) so that the adjustment is uniform. Your operator's manual will provide details for this process, but it normally involves adjusting the right and left or fore and aft sides of the concave to ensure they are uniformly spaced from the cylinder or rotor. This will ensure that in-cab adjustments are accurate across the width or length of the concave. A poorly leveled concave could damage grain on the high side while under-threshing grain on the low side. Consequently, it would be impossible to balance between grain loss and damage. Your operator's manual will give you starting clearances for your particular machine, but generally you'll need to set your concave approximately to the diameter of a shelled cob. A properly adjusted concave will break up some cob, but excessive broken cob is an indicator that the concave is set too close to the cylinder or rotor. Too many broken cobs can lead to high levels of cob in the clean grain tank or can overwhelm the cleaning shoe.

Cylinder or Rotor Speed
After the concave is adjusted properly, adjust the cylinder or rotor speed to maximize threshing in wet grain, but make sure you balance this adjustment with grain damage. If grain damage becomes excessive, slow the cylinder or rotor. Do not increase the concave clearance. Concave spacing has very little effect on grain damage in corn.

Cleaning Shoe
Always begin harvesting with the chaffer and sieve openings to the maximum specification in your operator's manual. Closing down the sieve will produce clean corn in the grain tank, but it will also increase tailings returned for rethreshing, which can increase grain damage. If there is too much cob in the grain tank, first try increasing airflow, then close the top chaffer sieve a little and finally the lower shoe sieve a little. Wet crop residue will require higher air speed compared to a dry crop.

Repair
As with any harvest conditions, a poorly maintained combine will lead to higher grain losses and increased grain damage. Typically you'll need to increase cylinder or rotor speed to compensate for worn parts. On a conventional combine, check the concave for wear and look for rounded edges on the crossbars. On a rotary combine, check the threshing elements for worn and rounded edges. Replace concaves and rasp bars if wear exceeds the tolerances stated by the manufacturer. Please consult your operator's manual or your local dealer for allowable wear tolerances.
If you've been using the chromed rasp bars to take advantage of its wear properties, you may consider switching back to a hardened rasp bars as the "ever-sharp" edges of the chromed rasp bar may be too aggressive on this season's soft kernel. Depending on your machine, there may be additional parts to improve threshing performance in wet crops. For example, some manufacturer's recommend rear concave inserts to improve threshing while others offer round bar concaves and separating grates to prevent crop hairpinning. Consult your operator's manual and/or your local dealer to determine what options are available for your combine.

For more information on this year's harvest including over-winter standability, storage options and drying costs, visit us at the University of Wisconsin Cooperative Extension Team Grain website at http://www.uwex.edu/ces/ag/teams/grains.

EFFECTS OF FROST DAMAGE ON YIELD AND DRYDOWN

The effects of frost on grain yield become smaller as the plant nears black layer. Severe frost will force the kernel to premature black layer even if the milk line has not reached the tip of the kernel. Dry matter accumulation will cease and test weights will be reduced. Stalks, husks, and grain have more tolerance to frost damage than leaves. Thin stands are more susceptible than thick stands. Drydown may be delayed four to nine days after a frost. The stalk and cob contain more water than normal maturing corn and this moisture must be lost before the grain can resume drydown. The husks on immature corn remain tight and reduce moisture loss out the end of the ear.

HANDLING FROST DAMAGED CORN

Determine the milk line by breaking ears in half and observing the tip half. The milk line is indicated by a change of color between the outside of the kernel and the tip. Black layer is determined by splitting the kernel from outside to the tip. Look for a black deposit at the tip. Grain moisture decreases as the milk line moves to the tip.

Milk Line Grain Moisture

Milk Stage	60%
1/8 down (full dent)	48%
1/2 down (late dent)	40%
3/4 down	35%
Black layer (mature)	32%

Storage

Dry Grain:

After harvest, grain that is in excess of 22% moisture should be dried immediately and stored to prevent spoilage and to inhibit further mold growth. If using a bin drying system, it is a good idea to dry the grain in layers of not more than 3 to 5 feet. Each layer should be completely dried before adding the next. If using a continuous flow dryer, dry the grain rapidly and then cool quickly to 35 – 45 degrees F to inhibit further mold growth. If mold is present, dry the grain to 13% or 14% moisture to decrease the chance of future problems. The drying process can kill some mold but it will not get rid of mycotoxins if they are present. Considering the initial condition of the grain, the bin should be checked frequently to ensure hot spots or mold conditions are not developing or getting worse. Be sure to pay particular attention to the center of the bin as this is typically where the fines and small particles build up. Molds are more likely to develop and grow in these areas because the fines and particles pack tighter and are more available as a food source. If any chance of mycotoxins exists, it is recommended that the grain be tested before sale. Expect discounted prices at the elevator if mycotoxins or molds are detected. Even with the discounted prices, it may be of benefit to sell the grain at harvest instead of taking the risk of storing grain that is not in a stable condition. If storage of grain is necessary, keep any good, clean grain separate from the infected grain to alleviate the chance of the mold growing or spreading.

Summary of Key Points for Storage of Dry Grain

- Dry rapidly to 13-14%
- Cool rapidly after drying to 35 – 45 degrees Fahrenheit
- Segregate clean grain from infected grain
- Monitor stored crop condition weekly by monitoring grain temperatures
- Sell as soon as market conditions or contracts allow
- Test grain for aflatoxins before selling (See Lab Links Below)

Dairyland Labs
Arcadia, WI
http://www.dairylandlabs.com/

Rock River Lab
Watertown, WI
http://www.rockriverlab.com/html/index.html

AgSource-Bonduel Labs
Bonduel, WI
http://agsource.crinet.com/page298/AgronomyFeed

A & L Great Lakes Laboratories Inc
Fort Wayne, IN
http://www.algreatlakes.com/

Iowa Testing Laboratories, Inc.
Eagle Grove, IA
http://www.iowatestinglabs.com/

Genetic ID, Inc.
Fairfield, IA
http://www.genetic-id.com/

Eurofins Laboratories
Des Moines, IA
http://www.eurofins.com/

Holmes Laboratory, Inc.
Millersburg, OH
http://www.holmeslab.com/

Diagnostic Center for Population & Animal Health
Michigan State University
Lansing MI
http://www.animalhealth.msu.edu/

Eurofins AvTech Laboratories, Inc.
Portage, MI
http://www.avtechlabs.com/

Great Lakes Scientific, Inc.
Stevensville, MI
http://www.glslab.com/

Litchfield Analytical Services
Litchfield, MI
http://www.litchlab.com/

Dairyland Labs
St. Cloud, MN
http://www.dairylandlabs.com/

Minnesota Valley
Testing Laboratories, Inc.
New Ulm, MN
http://www.mvtl.com/

Spectrum Analytic, Inc.
(An Agronomic Services Laboratory)
Washington Court House, OH
http://www.spectrumanalytic.com/

High Moisture Corn:

Although the target moisture content for high moisture corn is usually between 25-32% moisture, it may be a good idea to push the boundaries this year to achieve a rapid harvest. Producers may need to settle for corn in the 30-34% moisture range to get the crop harvested before mold conditions grow worse. If harvesting at a higher moisture, faster starch digestion in animals is expected and this should be considered when processing or cracking the corn. Less processing may be needed to achieve the proper rate of digestion. If mold is visible on the ears of corn in the field, the grain should be treated as if it contains mycotoxins. Although different molds produce varying levels of mycotoxins, and some none at all, it is a large risk to assume that the identified mold is safe. The grain should be treated before storage with an additive that will prevent further mold growth. These products include but are not limited to propionic acid, acetic acid, lactic acid, or inoculants such as L. Buchneri. Some of these additives can be used in combination to produce the most effective results. It is a good idea to consult an animal nutritionist before storing the grain to determine the best approach for inhibiting mold and mycotoxin growth. **Although it is not possible to lower existing mold and mycotoxin counts, it is possible to prevent further growth.** Before feeding, all corn with suspected mold counts should be tested for toxins using a commercial laboratory.

Summary of Key Points for Storage of High Moisture Corn

- Harvest promptly at the high end of acceptable moisture range
- Adjust processing based on moisture content at harvest
- A consideration may be to apply preservative treatments to inhibit further mold/mycotoxin development. Need to use the recommended full rate of each additive
  - **Organic Acids (Propionic, Acetic)**
    - In the silo, propionates reduce the negative effects of aerobic bacteria, yeasts, and molds, saving dry matter and energy for the cow.
    - May depress lactic acid fermentation
    - More expensive than inoculants
  - **Lactobacillus Buchneri**
    - Acetic acid producing bacteria
    - Acetic acid prevents mold/yeast growth
    - Improves aerobic stability in high moisture corn or silage
    - Does not increase the rate of fermentation (In cases of mold, stability may be more important than quick fermentation.)
  - **Lactic Acid producers (Not beneficial in mold situations)**
    - Lactobacillus plantarum, Enteroccocus species, Streptococcus faecium, Pediococcus species, and others.
    - Increase fermentation rate
    - Decreases dry matter loss in storage
    - Will not prevent or control mold/yeast growth
    - No aerobic stability advantage
- Consult with your animal nutritionist to determine which method of preservation/mold inhibition will work the best.

Feeding

Dry Grain and High Moisture Corn:

Feeding grain that contains molds or mycotoxins can be very challenging. Not all molds produce mycotoxins, but there are cases where mold and mycotoxins are not visible, but do exist. After taking every precaution possible in storing and treating the grain to inhibit mold growth, the first step is to test the feed for toxin levels. A list of laboratories with the ability to perform toxin screens can be found below. Toxicity tests range from $50.00 to $100.00. If toxins are found to be present, the species of animal in which the grain was intended as a feed source for needs to be considered. Different animal species have varying levels of tolerance to toxins in feed. There are a few options to decrease the effects of mycotoxins present in feed. A mold/mycotxin binder can be fed. These products will reduce the effects of the toxins, but not eliminate them. However, a binder or inhibitor may reduce the mycotoxin effect to a level that is safer to feed. The other option is to dilute the infected grain with clean grain until the combination is at a safe level for feeding. Feeding a binder and diluting the infected feed can allow a producer to still utilize the feed sources that are available to him. It is suggested that mycotoxin tests should be repeated periodically within each storage structure because grain from different fields may contain different levels of toxin.

Summary of Key Points for Feeding Corn with Potential Mycotoxin Contamination

- Test grain for mycotoxins before feeding (See link to labs)
- Work closely with animal nutritionist to develop a feeding strategy
- Dilution is a good solution
- Feed toxin/mold binders to decrease effects
- Monitor animals and production levels and look for red flags

Mycotoxin Levels and Effects on Animals

Most animals show some tolerance to mycotoxins. However, this varies depending on which mycotoxin is present, the species, age, and reproductive stage of the animals affected. The following table shows the effects of mycotoxins on different animals and at what levels the effects occur. After testing grain for mycotoxins and confirming their presence, this table can be used to determine the potential effects of feeding the grain to animals.

Zearalenone (ppm=parts per million)			
Swine	**Concentration**	**Duration**	**Effect**
Prepubertal gilts	1-5 ppm	3-7 days	Hyperestrogenism, prolapse
Sexually mature open gilts	3-10 ppm	Mid-cycle (day 11-14)	Anestrus, pseudopregnancy
Bred sows	15-30 ppm	1st trimester	Early embryonic death, small litters
Juvenile boars	10-50 ppm	Indefinite	Reduced libido, small testicles
Mature boars	200 ppm	Indefinite	No effect
Cattle			
Virgin heifers	12 ppm	Open Heifers	Reduced conception
Dairy cows	50 ppm	Open cows	Reduced conception
Poultry			
Broilers & turkey poults	200 ppm	Indefinite	No effect
Deoxynivalenol (vomitoxin, DON)			
Swine			
Feeder pigs	1-3 ppm	1-5 days	Reduced feed intake
Feeder pigs	5-10 ppm	1-5 days	50% reduction in feed intake, vomiting
Feeder pigs	10-40 ppm	1-5 days	Complete feed refusal, vomiting
Sows	3-5 ppm	Gestation, lactation	Lower fetal weights, or no effect
Cattle			
Feeder cattle	10 ppm	Indefinite	No effect
Dairy cows	6 ppm	6 weeks	No effect or slightly reduced feed intake
Dairy cows	12 ppm	10 weeks	No effect on milk production
Poultry			
Broilers and turkey poults	50 ppm	Indefinite	No effect
Fumonisins (FB1 and/or FB2)			
Horses	**Concentration**	**Duration**	**Effect**
All classes and ages	>10 ppm	30 days	Liver damage, leucoencephalomalacia, death
Swine			

All classes and ages	>25 ppm	30 days	Reduced gain and feed efficiency, mild liver damage
All classes and ages	>50 ppm	10 days	Reduced gain and feed efficiency, moderate liver damage
All classes and ages	>100 ppm	5 days	Severe pulmonary edema, death
Cattle and sheep			
All classes and ages	>100 ppm	30 days	Slightly reduced gain, mild liver damage
All classes and ages	>200 ppm	14 days	Reduced feed intake and gain, moderate liver damage
Turkeys			
All classes and ages	>100 ppm	7-21 days	Reduced feed intake, liver damage, diarrhea, rickets, tibial lesions
Chickens			
All classes and ages	>200 ppm	7-21 days	Reduced feed intake, liver damage, diarrhea, rickets, tibial lesions
Aflatoxins (ppb=parts per billion)			
Swine	**Concentration**		**Effect**
All classes and ages	200 ppb		Slow growth, reduced feed efficiency
All classes and ages	400 ppb		Liver damage and immune suppression
Feeder cattle			
All classes and ages	400 ppb		Tissue residues
All classes and ages	700 ppb		Mild liver damage, reduced growth and feed efficiency
All classes and ages	1000 ppb		Moderate liver damage and weight loss
All classes and ages	2000 ppb		Severe liver damage, jaundice, death
Dairy cows			
Lactating cows	20 ppb		Detectable aflatoxin in milk
Lactating cows	1500 ppb		Decreased milk production
Poultry			
Broiler chicks	210 ppb		No effect
Turkeys	250 ppb		Reduced growth
Broiler chicks	420 ppb		Lose weight, moderate liver damage after 3 weeks
Horses			
All classes and ages	400 ppb		Liver damage and immune suppression
Munkvold, G., Osweiler, G., Hartwig, N. 1997 Iowa State University Ext. PM-1698			

Planning for Next Year

Can I do anything to prevent this next year?

Fungal lifecycle

The fungi that cause ear and kernel rots of corn over season in crop residues, in or on the soil surface, or in stored grain. In corn on corn situations the number of fungi tends to increase. However, these fungi are so common and widespread in the Corn Belt that crop rotation and a clean plowdown of crop residues would make little difference in the total inoculum levels. The microscopic spores are spread by air currents, rain, birds, insects, mites, and humans. The spores need favorable temperatures and the presence of moisture to germinate. The fungi then penetrate the husks, kernels, cob, or shank.

Areas of consideration for reducing impact

- Control insect damage, broadest spectrum of control using SSX hybrids
- Use proper fertility to maintain plant health
- Consider a fungicide where applicable
- Consider hybrids with strong disease packages

While these points will help reduce your mold risk, all hybrids are susceptible under favorable conditions.

Mold & Mycotoxin Flowchart