High Moisture Corn Harvest and Storage Considerations

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Even the best plans to ensile high moisture corn at the proper moisture level are sometimes thwarted by weather and time constraints. These types of situations prompt the question, "What can I get away with?" Here are some factors and suggestions to consider when making decisions regarding the harvest and storage of high moisture corn.

Moisture

Consider the type of silo first. High moisture corn can be stored in conventional, oxygen-limiting, bunker, or bag silos. Recommended moisture levels for these silo types are presented in Table 1.

Table 1. High Moisture Corn Storage in Conventional, Bunker, Bag, and Oxygen Limiting Silos

Conventional Top Unloading Silos, Bunkers, and Silo Bags			
	Corn Kernel Moisture, %		
	Minimum	Desired	Maximum
Ear Corn	26	32-36	40
Shelled Corn	26	28-32	36

Bottom Unloading Oxygen Limiting Silos			
	Corn Kernel Moisture, %		
	Minimum	Desired	Maximum
Ear corn-rolled*	26	28-32	36
Shelled corn	24	26-28	32

**OL Silo with Forage Unloader*

In years when crop maturity has lagged behind normal or frost puts an early halt to the growing season, corn may be wet (or dry slowly) and maximum moisture percentage to preserve corn becomes a primary issue. For corn stored above 40% moisture, an undesirable fermentation may take place and yeast may proliferate along with high ethanol levels. Animal acceptance may be poor with this type of fermentation. Additionally, harvesting high moisture shelled corn above 32% kernel moisture for oxygen limiting silos equipped to handle high moisture shelled corn may result in unloading problems.

Processing

Most high moisture corn is processed (rolled or ground) before going into the storage unit. The two exceptions to this rule are shelled corn being stored in an oxygen limiting unit and corn that is excessively wet (near 35% kernel moisture). Take care not to over process corn that is

over the desired moisture level. It is easy to get excessively fine high-moisture corn that may result in rumen acidosis, fat test depression, off-feed problems or an increased incidence of displaced abomasums. As the corn approaches optimum moisture content, increase the degree of processing.

Harvest Recommendations

Check corn kernel moisture from different fields and determine if the grain can be removed from the cob (shelled corn). Harvesting high moisture corn as shelled corn as compared to snaplage or high moisture ear corn may reduce mycotoxin risk. Harvest corn nearest to optimum moisture contents first and place at the bottom or back of storage structures. Corn with higher than desirable moisture levels may more of a problem at feed-out during the warm months and is best to put on the top or front of the silo for winter feeding. Very wet corn may be prone to aerobic instability (heating) upon removal from the silo. Plan to feed higher risk (wet or moldy) high moisture corns during the coldest months to facilitate slow removal rates if needed.

Corn with significant mold on the kernels and cob is best harvested and stored as high moisture shelled corn (rather than ear corn). Some producers have taken moldy corn and dried it down to storable moisture while screening off the fines. Where drying is not an option, propionic acid is recommended. The propionic acid will not lessen any problems from the mold, but will likely prevent mold problems from getting worse.

If high moisture corn is stored in bags, locate bags away from trees, long grass, and keep snow removed from around the bags. For best results, remove bagged high moisture corn during cooler months. Punctures, rips, or tears in the summer can cause rapid and expansive spoilage.

Preservation

High moisture corn offers some unique preservation challenges compared to corn silage because it ferments more slowly and less extensively while containing high levels of starch, which promotes aerobic deterioration. Any aid to hasten fermentation, use up available oxygen, and inhibit yeast growth (once exposed to oxygen) is beneficial in the ensiling process. Several options are currently available to producers. Here's a quick rundown of each:

<u>Standard bacterial inoculants</u>

High moisture corn inoculants have been available for many years. These primarily produce lactic acid during the fermentation process (homofermentative) and increase the speed of fermentation, while reducing dry matter loss. They MAY also increase animal performance. Choose an inoculant that has been specifically developed for ensiling high moisture corn. Specific strains of bacteria may not grow well on all crops and across a wide range of moisture contents. Thus, a corn silage inoculant may or may not work well under the drier conditions of high moisture corn. Most standard high moisture corn inoculants were developed to improve fermentation. For this reason, aerobic stability during and after feed-out may not be significantly improved. In fact, some standard lactic acid producing bacterial inoculants may actually improve fermentation but decrease aerobic stability (heating at feedout). With all

inoculants, it is important to follow the manufacturer's application rates. Typical rates are between 100,000 and 500,000 colony forming units (cfu) per gram of high moisture corn.

Lactobacillus buchneri

Lactobacillus buchneri is a unique bacterial inoculant that has been developed to improve aerobic stability of silages and high moisture corn by reducing the growth of yeasts. The net result is grains inoculated with *L. buchneri* are more resistant to heating when exposed to air as compared to untreated silages. *L. buchneri* was originally isolated from naturally occurring aerobically stable silages. It is a heterofermentative bacteria that produces both lactic and acetic acid during fermentation. Silages treated with an effective dose (600,000 CFU/gram of wet corn) of *L. buchneri* have higher concentrations of acetic acid and lower levels of lactic acid than untreated silages.

The beneficial impact of *L. buchneri* appears to be related to the production of acetic acid. Although the precise mechanism has not yet been determined, it is likely that aerobic stability is improved because acetic acid inhibits growth of specific species of yeast that are responsible for heating upon exposure to oxygen. As a result, the temperature of fermented feed inoculated with *L. buchneri* does not readily rise upon exposure to air and tends to remain similar to ambient temperature for several days, even in warm weather. Using *L. buchneri* often results in a slightly higher dry matter loss during fermentation compared to standard homofermentative bacterial inoculants.

L. buchneri is a well-researched, highly effective inoculant to use for high moisture corn preservation in all storage units. Use of L. buchneri improves aerobic stability and this is important if high moisture corn removal rates need to be reduced because of mycotoxins or excessively degradable starch.

Propionic acid

Preserving high moisture corn with propionic acid or propionic acid mixtures (propionic, acetic, benzoic) has been a proven effective practice for many years. However, it is more costly than simply using a standard inoculant and requires specialized equipment to apply. There are several situations where the use of propionic acid to reduce pH and preserve corn makes good sense. In years past, some producers have successfully used concrete or wood floors/bins to store high moisture corn. In this case, it's a must that corn be treated with propionic acid. Applying propionic acid at the proper rate reduces the pH of preserved corn to about 4.0 and inhibits the growth of harmful microorganisms. The cost of treatment is usually comparable to that of on-farm drying.

The proper application rate depends on two factors: 1) the moisture content of the grain, and 2) the intended length of storage (Table 2). Rates are based on pounds of actual acid. It's most economical to treat corn with acid when kernel moisture is near 30 percent. It typically takes 10 to 20 lbs. of actual acid to fully preserve a ton of high moisture corn.

Another situation where acid may prove beneficial is when an upright silo is being filled but not fed from for an extended period of time. In this case, producers often only apply acid to corn that will fill the last 5 to 10 feet at the top of the silo. It is at the top where spoilage is most likely to occur as a result of oxygen infiltrating the grain. Again, determine rates based on length of storage and moisture.

Table 2. Recommended application rates of propionic acid to preserve high moisture corn

Corn moisture %	Lbs. propionic acid to apply per 1000 lbs. wet corn[1]		
	----------Months corn to be stored----------		
	6	9	12
20	3.3 - 5.0	4.0 - 6.0	5.0 – 7.5
25	5.0 - 6.5	6.0 - 8.5	7.5 – 10.0
30	6.5 - 8.5	8.5 - 11.0	10.0 – 12.5
35-40	8.5 - 10.5	11.0 - 14.0	12.5 – 15.0

[1]Use lower rate for well-mixed corn and higher rate if acid and grain cannot be well-mixed.

Feedout

Be careful to plan for variable removal rate from the silo. A removal rate of 3 to 4 inches per day is typically required to prevent heating during feeding in warmer weather. However, if the high moisture corn contains mycotoxins or is wet with rapidly degradable starch, which may induce acidosis, the removal rate may need to be reduced to augment the addition of clean dry corn to the diet. Treating the bottom third to half the silo of high moisture corn with *L. buchneri* or propionic acid (12-15 lb/ton) may be desirable to insure flexible removal rates and maintain quality during warm weather feeding.