2009-2010 Dairy Cattle Feeding Issues with High-Moisture Corn, Snaplage and Dry Shelled Corn

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Cooler than normal summer growing conditions coupled with a killing frost in early October is causing high-moisture (HM) and dry corn to be harvested at higher than normal moisture contents. Dairy cattle feeding issues that may arise during feed-out of wet HM corn include: reduced starch content, fast rate and high extent of ruminal starch digestion, and mold/mycotoxins. Some of these same issues may also arise with feeding corn harvested for dry shelled corn that had been exposed to a killing frost prior to reaching physiological maturity.

High-moisture corn is most commonly combine-harvested as shelled or ear corn. This year there will likely be more snaplage harvested and fed, because harvesting as snaplage allows for greater kernel moisture at harvest using silage choppers equipped with a snapper head and an on-board kernel processor to hasten the harvest. Snaplage contains kernels and cob and varying amounts of husk and ear shank. Therefore, one can expect the neutral detergent fiber (NDF) content to be higher and the starch content to be lower for snaplage than HM ear corn. Furthermore, the concentrations of NDF and starch in snaplage can be highly variable. Dairy cattle feeding issues that may arise during feed-out of snaplage include: variable starch, NDF, energy and dry matter (DM) concentrations, fast rate and high extent of ruminal starch digestion, and mold/mycotoxins.

Starch, NDF and DM Concentrations

The normal starch content of shelled corn in the Midwest is 68% to 70% (DM basis). Corn that went through a killing frost prior to reaching the black-layer stage or physiological maturity may contain less starch and possibly energy. Snaplage hybrid test plot data from southeastern MN showed that starch, NDF and DM concentrations ranged from 55% to 64%, 14% to 22% and 53% to 67%, respectively (Mahanna, 2008). Commercial feed testing laboratories routinely analyze HM corn, dry shelled corn and snaplage for starch and NDF concentrations and can estimate the energy value of corn from its nutrient composition using summative energy equations; this should be done during feed-out. Knowing the starch and NDF content and energy value of corn will allow dairy cattle nutritionists to adjust the feeding rate of the corn accordingly during ration formulation. Depending on the other ingredients in the ration, the quality of the snaplage, the nutrient composition of the ration and the level of milk production of the dairy herd, there may be a need to supplement dry ground shelled corn along with the snaplage to meet the dietary energy requirement. It will also be important to determine and monitor the DM content of the HM corn and snaplage frequently on the farm so that the as-fed feeding rates can be adjusted accordingly and the desired amounts of DM fed.

Ruminal Starch Digestion

Corn that is harvested with more than 32% kernel moisture and preserved as HM corn can have a fast rate and high extent of ruminal starch digestion, especially if processed finely. Current research suggests that the rate of starch digestion for HM corn will increase as the length of storage time increases, which means that the rate and extent of ruminal starch digestion for HM corn may be higher the following spring or summer relative to the fall feeding period. Depending on the other ingredients in the ration and the nutrient composition of the ration, a fast rate and high extent of ruminal starch digestion could result in reduced ruminal pH and fiber digestion and a depression in milk fat test. A coarse roll (2500-3000 micron mean particle size) is all that is needed for processing of wet HM corn. Sometimes though the normal corn harvest and storage processes, moving corn through combine, augers, roller mill, and silo blower and un-loader, can cause wet HM corn to become too fine. The particle size of HM corn should be determined at commercial feed testing laboratories using sieving procedures. For wet HM corn a mean particle size less than 1,500 microns may be cause for concern in some feeding situations. If animal performance issues arise from the feeding of wet - fine HM corn then the following options may be considered by dairy cattle nutritionists: reduce the amount of corn fed, partially replace the wet - fine HM corn with dry - coarser dry shelled corn, reduce the dietary starch content by partially replacing the wet - fine HM corn with high digestible byproduct fiber sources, and (or) increase the amount of buffer being fed.

A coarse roll is all that is needed for processing of snaplage to break the kernels. If animal performance issues arise from the feeding of snaplage which has had the kernels processed too finely then the following options may be considered by dairy cattle nutritionists: partially replace the snaplage with dry - coarser shelled corn, and (or) increase the amount of buffer being fed.

Mold/Mycotoxins

The risk for mycotoxin contamination in HM corn or dry shelled corn first requires proper identification of the different ear. Scouting should occur as soon as possible to identify the type of ear mold and extent of the disease in the field. Based on various reports from around the state, the primary ear molds include Diplodia, Fusarium, Gibberella, and Penicillium. Conditions have been less favorable for the development of Aspergillus. In terms of mycotoxins, there is a lower risk of mycotoxin contamination in ears that have Diplodia or Penicillium, compared with Fusarium and Gibberella.

Symptoms of Diplodia ear rot include a heavy or thick white mass of mold, where the kernels almost appeared "glued" to the husk. These symptoms will most often be observed at the base of ear. Infections of Diplodia occurred during the tasseling to early silking period. Fusarium ear rots can be caused by different species of *Fusarium* and symptoms will vary greatly depending on hybrid and environment. Typically, symptoms are whitish to pink and can also cause a "starburst" appearance on the kernel. Infected kernels are usually scattered throughout the ear. Gibberella ear rot symptoms also appear reddish in appearance, but infected kernels are more likely to be found starting from the tip of the ear. Lastly, Penicillium ear rot is characterized by a powdery green or blue green mold on and between kernels. Areas where damaged has occurred on an ear often show the initial symptoms.

Mycotoxin development is highly dependent on the environment, factors that may cause wounding on the plant, or can occur when resource demand is high or resources are limiting. Temperatures above freezing, moisture above 20%, and oxygen are key factors for mycotoxin contamination. The longer corn remains in the field, the higher the risk for mycotoxin development. Grain that is damaged in the field should not be mixed with good grain. Proper drying ensiling conditions can help reduce the risk of contamination, however, it is important to monitor grain bins throughout the winter period since can be contamination that occurs towards the end of silage use when an infection occurred in the field. It is recommended to test HM corn or dry shelled grain for mycotoxins from any field where there was evidence of ear molds before feeding to animals (Table 1).

Fusarium mycotoxins: These mycotoxins include deoxynivalenol (DON; produced by several species of *Fusarium*, including *F. graminearum*), zearalenone (*F. graminearum*), and fumonisin B1 and T-2 (multiple species of *Fusarium*). Of these mycotoxins, DON is the most common. In silage, DON does not appear to have a significant effect, however, in grain, production of DON is favored by grain moisture of 21% or more and temperatures from 21-29°C. It is thought that rumen microorganisms are also able to degrade DON to less toxic form.

Penicillium mycotoxins: In silage, *P. roqueforti* is a common fungus. This organism is a saprophyte that grows well in low oxygen and acidic environments. There are multiple toxins produced by *P. roqueforti*, including, PR toxin, roquefortin C, patulin, and mycophenolic acid. While the effect of these toxins on dairy cattle is not well known, proper harvest timing and ensiling can reduce the risk of toxin development.

References and Resources

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Table 1. Directory of mycotoxin laboratories. Labs may offer qualitative and/or quantitative analysis of different mycotoxins. We recommend that individuals contact laboratories directly to find out how best to prepare a sample for submission, prices and services offered, and other additional details that may be required to conduct a proper test. For further information, please consult A3646-Pest Management in Wisconsin Field Crops.

Covance Laboratories 3305 Kinsman Boulevard Madison, WI 53707 (608) 241-4471	Midwest Laboratories 13611 B Street Omaha, NE 68144 (402) 334-7770	Veterinary Diagnostic Labs Iowa State University 1600 South 16th Street Ames, IA 50011 (515) 294-1950
Centralia Animal Disease Laboratory Illinois Department of Agriculture 9732 Shattuc Road Centralia, IL 62801-5858 (618) 532-6701	Romer Labs, Inc. Attn: Analytical Services 1301 Stylemaster Drive Union, MO 63084-1156 (636) 583-8600	Veterinary Medical Diagnostic Laboratory 1600 East Rollins Columbia, MO 65211 (573) 882-6811
Dairyland Laboratories 217 East Main Street Arcadia, WI 54612 (608) 323-2123	Veterinary Diagnostic Laboratory North Dakota State University 174 Van ES Hall Fargo, ND 58105 (701) 231-8307	Woodson-Tenent Laboratories 3507 Delaware Avenue P.O. Box 1292 Des Moines, IA 50313 (515) 265-1461