Corn Breakage Increases with More Drying

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Abstract
As we observed a few weeks ago, the 2008 corn crop is wetter and lower in test weight than average corn. Long, cool growing seasons produce high yields but the corn is wet and soft, with more soft white starch. This means lower test weight, and reduced storability as mold can invade the softer textured kernels more rapidly. It also takes more energy to remove water from softer corn.

Keywords
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Corn Breakage Increases with More Drying

By Charles Hurburgh, Department of Agricultural and Biosystems Engineering

As we observed a few weeks ago, the 2008 corn crop is wetter and lower in test weight than average corn. Long, cool growing seasons produce high yields but the corn is wet and soft, with more soft white starch. This means lower test weight, and reduced storability as mold can invade the softer textured kernels more rapidly. It also takes more energy to remove water from softer corn.

Many farmers and elevators are taking from 8 up to 10 percentage points of moisture out of corn. If done with heat, the corn will inevitably be more sensitive to handling breakage, and create dust or fines. Broken corn is also more susceptible to molding. Reports of nearly 10 percent broken corn have come in. The long term average is about 3 to 5 percent. Taking precautionary actions will reduce loss due to these conditions. Remember to wear a two-strap dust mask in dusty conditions as a personal safety precaution; dust, and potential fire hazards will be increased this year.

Drying
Rapid transition from heat to cool aggravates the breakage problem. Each subsequent handling causes more broken grains; it is almost impossible to keep up by cleaning the corn. Cleaning before the dryer will not help very much because most of the breakage happens when the dry corn is handled. Try not to let the corn (not the air) temperature exceed 140°F and cool more slowly in a bin rather than in the dryer column. This will also increase dryer capacity by about 1 to 2 percentage points of moisture.

Handling
In the last few years, corn quality was good and handling system problems did not show up. Places where grain hits solid surfaces (elbows in piping, misaligned or worn spouts, slide gates not smooth, etc.) are points where breakage happens most. Cushion boxes and dropping grain on grain helps. The breakage in a grain on grain impact is about 50 to 70 percent of the breakage in the same impact with a solid surface.

Limit drop heights to less than 40 feet. This may mean not emptying bins completely, or using flow retarders that choke the grain flow periodically and take away momentum. A pipe with holes is often used for outdoor piles; the pipe fills up to whatever height is needed to make the flow out of the holes keep up with the loading rate.

Take a careful inspection of handling systems. Worn parts will show up this year. Augers are particularly hard on grain when the flighting wears and becomes sharp. Reduce chain and auger speeds where possible. Be very careful of bends and elbows in pneumatic conveyors; the breakage rate goes up rapidly with grain speed and corners in these systems. In all cases running handling equipment slower but fuller is better than fast and partially full.

If cleaning is necessary to make grade or for storage reasons, 3/16 square
mesh screens will remove most of the small pieces. Some rotary cleaners use one-fourth inch screens; this will take out nearly all broken grains and some small kernels as well. If you are feeding the fines directly, then the additional removal may be worthwhile to gain storage quality. Integrate the cleaner into the regular handling path to storage, in order not to create additional handling. The benefits in airflow increase, and storage quality of corn cleaner than the allowable grade limit will likely outweigh the cost of cleaning and the loss of corn weight, if the cleanings can be fed locally.

Storage
Fines will settle under spouts. A distributor does not throw light, fine material too far; there will be a doughnut ring of fines under a slinger-type distributor. There are other distributor types that physically carry the material farther out in the bin, but larger diameter bins (40 feet and up) will almost always have a concentration of fines in the middle. Estimate that the middle of a bin will have about 10 times the fines concentration as the edge.

Fines restrict airflow, which is why wetter corn and spoilage is most likely in the center. This year’s wet corn, with more bin cooling and more fines, will have particular problems in this way. The best way to help this situation is to take the center core (enough grain so the inverted cone reaches at least half the bin diameter) out. Clean this corn, feed it to animals right away, or sell it. If the system uses bin cooling, the core will have to be removed periodically because grain is coming in all the time. Stirring systems will filter fines to the bottom; complete bin cleanouts will be needed this year to keep the drying floors or ducts from becoming obstructed. The fines will also harbor insects.

Be able to aerate and monitor temperature in all storage bins. A bin that starts to heat and go out of condition will be a constant problem in the future. The common practice of turning (moving) problem grain may not be useful this year because the movement will create yet more broken corn. Be ready to sell or use corn if problems arise.

Markets
The discounts for fines (Broken Corn-Foreign Material, BCFM) generally start at 5 percent (No. 2 corn). In recent years, BCFM has not been an issue and so the discount amounts were small. Expect more checking this year. The correct screen size for measuring BCFM is 12/64 round hole. There will be broken pieces larger than this screen size, but those are not counted in the Grade Factor BCFM.

Ethanol plants can relatively easily use broken corn, as long as it is not moldy. Corn wet and dry mills cannot. Exporters will also test more, because the corn is handled numerous times before the end user, and any cleanout necessary to make grade is economic loss. Broken corn typically sells for 50 to 75 percent of corn price. This year, however, there may be buyer concerns because mold toxins (fumonisins, vomitoxin, and others) will concentrate in the broken pieces. If you are feeding fines, it would be good to test for mycotoxins, especially if the fines have been stored for more than a few days.

Summary
The 2008 corn crop will be more prone to breakage, and will contain more broken grains. Cleaning and coring can help, along with minimizing the number of handleings. Corn that will be held until next summer will need particular attention to be clean, uniform in moisture, and of the highest test weight available.

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