Corn fines impact corn's value

by Alvaro Garcia

A USUAL complaint that comes from corn buyers is the presence of fines and broken kernels. In fact, it's the number one concern of international buyers when comparing U.S. corn to other sources. Harvesting and drying are major contributors to breakage potential of any corn hybrid regardless of their original "brittleness." Combines, for example, inflict variable damage to the kernels that can either be apparent or hidden as small cracks.

Damaged kernels suffer additional physical stresses during transport and repeated auger loading and unloading. In addition, drying at higher temperatures and shorter times causes kernel stress-cracks, potentially resulting in further grain deterioration and more broken particles. Broken corn, in turn, is more susceptible to mold and insect damage than whole kernels, and it can cause problems in handling and processing.

Do fines impact nutritive value?

Corn grain has a high concentration of energy-yielding nutrients. Of these nutrients, starch dominates by weight, constituting roughly 73% of the total, followed by protein (8%) and oil (4%). Because of these proportions, starch content has the greatest effect on the energy value of corn.

Starch is composed of glucose units linked in linear or branched chains (of easier degradation). These two different types of starch are labeled vitreous (glass-like) and floury endosperm. Just remember that glass-like refers to its translucid appearance and not that it breaks easily! Ruminal starch digestibility of floury endosperm has been reported to be 32% greater compared to vitreous corn.

Recent work by the U.S. Grains Council compared the vitreousness of corn from three different origins Brazil, Argentina, and the U.S. Brazilian corn had the highest vitreousness averaging 72.3%, followed by Argentina with 65.5%, and then the U.S. corn with 47.2%. While these results explain why U.S. corn breaks more easily, they also suggest that the presence of more floury starch indicates its positive impact on digestibility.

What's the usual concentration?

Broken corn is labeled in the trade as BCFM (broken corn and foreign material), which are those particles small enough to pass through a 12/64th-inch round-hole sieve, and too large to pass through a 6/64th-inch round-hole sieve. Average U.S. BCFM in 2021 was 0.7%, which was well below the maximum observed for U.S. No. 1 grade at 2%.

Because of the commercial importance of this fraction, it was decided to analyze its nutritional composition to determine nutritive value (Table 1). The analytical values showed starch is reduced in BCFM by approximately the same proportion as the other nutrients increase. As a result, the BCFM energy content was only slightly affected, resulting in 98% of the value of corn.

Bear in mind this comparison is on a similar weight basis, but since BCFM constitutes at worst 2% of an entire corn shipment, this makes its influence on the overall nutritive value even less impactful.

Are there risks?

The cuticle protects the contents of the corn kernel from the attack by mold and bacteria. Once this barrier is broken or weakened, it is much easier for these deleterious organisms to access the nutrients within. Molds and their toxins are the ones that pose the greatest risk to the animal.

In research performed at Virginia Tech, samples from a bin were collected with a probe at depths of 3, 9, and 15 feet. The proportion of fines was higher closer to the surface (3 feet) than deeper in the bin, which explains the lower grain density observed at this depth (Table 2). Aflatoxin concentration was also higher in samples collected at 3 feet than the samples taken at the other depths (see graph).

The difference in aflatoxin concentration at different locations within a bin underscores the importance of getting representative samples when assessing mycotoxin concentrations. Screening to remove fines can be an effective and practical way to reduce mycotoxin concentrations to levels that pose less of a risk.

These results have implications.

1. The upper portion (3 feet) of a bin is where there is greater concentration of molds and mycotoxins.

2. When sampling corn to test for mycotoxins, obtain a representative sample from several depths.

3. Density (g/L) can be a good indicator of whether the stored corn is more susceptible to mycotoxin contamination; 700 g/L or lower densities merit the use of anti-caking agents/binders. This will allow prioritization of use where it will provide the best return on investment.

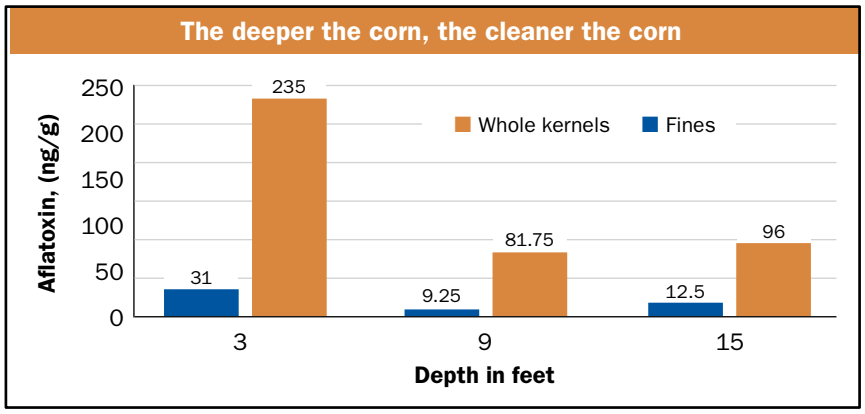

Table 1. Nutrient composition of corn grain and BCFM (percent)

	DM	CP	ADF	NDF	Starch	Fat	Ash
BCFM	87.8	9.2	4.7	11.4	64.9	4.8	2.0
Corn	86.9	8.2	2.4	7.4	72.7	4.2	1.5

Energy concentration was predicted as :
NEL Mcal/kg= 2.139-(0.0376*ADF)
NEL Mcal/kg= 2.139-(0.0376*4.7) = 1.96 Mcal/kg

Table 2. Dry matter and density of corn grain using a probe sampler

	Dry matter (%)	Bulk density (g/L)
Sample depth (feet)		
3	87.7	689
9	88.7	702
15	88.6	718
Sample fraction		
Whole kernels	87.8	756
Fines	88.8	620
SEM	0.16	3

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