Quality issues in the 2016 crop

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**Quality issues in the 2016 crop**

Charles R. Hurburgh, professor, Agricultural and Biosystems Engineering and professor in charge, Iowa Grain Quality Initiative, Iowa State University

**Factors affecting grain quality**

The 2016 growing season was generally wet with two distinct temperature patterns; hot early during pollination and cooler later. Most of Iowa had 125% up to 200% of normal rainfall to Labor Day, and yet more after Labor Day. The outlook going forward into winter is continued above average temperature. These conditions produced high yield potential at the start of September, but deteriorating quality after Labor Day. Crop quality is normally established by conditions at the very end of the growing season. The massive rains in the Northern third of Iowa complicated the need to move quickly on deteriorating grain.

Corn was susceptible to field mold. Some yield was lost, but more importantly, field dry-down and storage properties were reduced. Warm and humid weather persisted which increased fungal invasion of stalks. Stalk rots progress into the cobs, and eventually into the ears. We had a similar situation last year, but the weather turned to very low humidity at the end of September through November, which removed the mold threat. Soybeans quickly match moisture to air conditions. Moisture in the 14-16% range were common.

For examples of fungi on ears, see http://crops.extension.iastate.edu/cropnews/2016/09/scout-now-ear-rots. Some fungi, such as diplodia ear rot, do not produce mycotoxins while others such as fusarium or aspergillus can be toxigenic. The wide range of fungi on samples this year created the unusual situation of scattered reports for all four major mycotoxins – aflatoxin, vomitoxin, fumonisin and zearalenone. Expect most users to screen inbound grain for mycotoxins.

One way for a buyer to track the situation in a given area is to collect a 10-lb daily composite sample for toxin testing. Composite means combining some grain from each of the deliveries in a period. The USDA-GIPSA grain inspection agencies have the capability to test for the mycotoxins of most concern - aflatoxin, vomitoxin, zearalenone, and fumonisins. Toxin test kits are now simplified to the point where elevators and processors can do their own, but the USDA results provide a good benchmark. USDA-GIPSA agencies in Iowa are listed at https://www.gipsa.usda.gov/fgis/serviceproviders_listing.aspx.

Moldy grain from the field will have shorter storage life than average, at the same moisture and temperature. Table 1 represents the long term average for storage time and temperature. For grain carrying field mold, expect 60% to 70% of normal shelf life.

<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>13%, 11%</th>
<th>14%, 12%</th>
<th>15%, 13%</th>
<th>16%, 14%</th>
<th>17%, 15%</th>
<th>18%, 16%</th>
<th>24%, NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>150</td>
<td>61</td>
<td>29.0</td>
<td>15.0</td>
<td>9.4</td>
<td>6.1</td>
<td>1.6</td>
</tr>
<tr>
<td>50</td>
<td>84</td>
<td>34</td>
<td>16.0</td>
<td>8.9</td>
<td>5.3</td>
<td>3.4</td>
<td>0.5</td>
</tr>
<tr>
<td>60</td>
<td>47</td>
<td>19</td>
<td>9.2</td>
<td>5.0</td>
<td>3.0</td>
<td>1.9</td>
<td>0.3</td>
</tr>
<tr>
<td>70</td>
<td>26</td>
<td>11</td>
<td>5.2</td>
<td>2.8</td>
<td>1.7</td>
<td>1.1</td>
<td>0.2</td>
</tr>
<tr>
<td>80</td>
<td>15</td>
<td>6</td>
<td>2.9</td>
<td>1.6</td>
<td>0.9</td>
<td>0.9</td>
<td>0.06</td>
</tr>
</tbody>
</table>

* Based on 0.5% maximum drymatter loss–calculated on the basis of USDA research at Iowa State University. Corresponds to on grade number loss; 3-4% pts of total damaged seeds.
The storage life of grain starts immediately after harvest and is shortened significantly by periods of storage at warm temperatures. One day of holding warm wet corn before drying can use as much as 50% of the storage life, which means that spring and summer storage problems will be more likely. Holding wet corn can also result in blue eye mold development which lowers the Grade but does not produce mycotoxins. Soybeans are sometimes overlooked in the need to cool grain immediately; yet soybeans are more often harvested in warm weather compared to corn.

Corn dried by slower drying methods (natural air or low temperature) will require careful monitoring all year. These systems create potential for additional spoilage before the grain gets dry. They depend on the grain getting cold during the drying process. Old and new crop grain should not be mixed in the same bin because of the interaction of old crop which has used much of its storage time and the new crop that is still equilibrating moisture.

In overall quality, corn and soybean test weights are average. Protein content of corn is slightly below average, and starch content slightly above average. Soybean protein is somewhat low and oil is high, approximately 34.5% protein and 19% oil, except in areas that had extreme September rains which halted crop development at the further expense of protein content.

There were instances of river and stream flooding of fields in September 2016. Grain submerged by uncontrolled flood waters is considered Adulterated under the Food Drug and Cosmetic Act. This policy dates to 2008 when grain storages in Cedar Rapids were inundated, and has been applied to several situations since then. Adulterated material cannot be put in commercial facilities of any type, where there would be a chance of entering human or animal food. There were flooded (over the grain height) fields in northeast Iowa since mid September. Late September rains increased the scope of this problem in north central and east central Iowa as well. For more information, see http://crops.extension.iastate.edu/cropnews/2016/09/management-flood-submerged-grain

**Cooling needs**

Now that we are at the end of harvest, attention should turn to storage and storage conditions. The primary need is to cool grain that was either warm from the field or warm from being dried. Air conditions normally allow grain to be cooled progressively into the 40s in October and the 30s or below in November. Much stored grain is at temperatures in the 60s and 70s. Cooling conditions have not been ideal. Warm temperatures coupled with high humidity to cause high dewpoints. Dewpoint is a rough measure of the lowest possible temperature to which grain can be cooled at a particular time. For example, in central Iowa there were only five days in September and October with average dewpoints below 45 degrees F. See Figure 1, below. Dryers and storage bins were not been able to get grain cool to this point.

The 8-14 day outlook (http://www.cpc.ncep.noaa.gov/products/predictions/814day/) is for higher than normal temperatures over most of the central United States. This is not favorable for reducing stored grain temperatures into the 40s or below. Bins with lower airflow rates will be at most risk. It takes about 150 hours for 0.1 cfm/bu (a typical airflow rate in bins and other large storages) to make a full change in temperature (a cooling cycle). This time is proportionately different for higher and lower airflow rates, which means that bins designed with airflow rates above those necessary for aeration alone can take advantage of shorter periods of favorable cooling conditions.

**Storage situation**

The balance of production and storage in Iowa continues to tighten every year, as carryovers rise. The balance is an estimate of the amount of grain (primarily corn) that will have to be stored temporarily in non-permanent places, such as outdoor uncovered piles. Grain consumption in Iowa is about 250 million
bushels per month. It will take about 3-4 months to find permanent places for the grain in temporary storages. Lack of cold weather will present management challenges for outdoor piles that typically are not aerated.

![Image of Dewpoint Temperature Patterns](image)

**Figure 1.** Dewpoint temperature patterns for central Iowa in September and October, 2016.

**Table 2.** Storage versus production for Iowa corn and soybeans.

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>billion bushels</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>3.06</td>
<td>3.13</td>
</tr>
<tr>
<td>On hand (9/01)</td>
<td>0.37</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Total to Store</strong></td>
<td><strong>3.43</strong></td>
<td><strong>3.55</strong></td>
</tr>
<tr>
<td>Storage</td>
<td>2.90</td>
<td>2.90</td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td><strong>0.53</strong></td>
<td><strong>0.65</strong></td>
</tr>
</tbody>
</table>

Source: USDA reports.

**Summary**

End of season weather created a number of challenges for crop quality in 2016. Record rainfall and warm humid air conditions encouraged mold growth, and created flooding in northern Iowa. The major concern going forward is continued above normal temperatures with high dewpoints, which makes cooling of stored grain difficult.

**Additional resources**

http://crops.extension.iastate.edu/cropnews/2016/10/2016-harvest-grain-quality-update
http://crops.extension.iastate.edu/cropnews/2016/09/wet-weather-creates-challenges-harvest