Grain storage and management in a difficult harvest

IGQI Advisory Committee

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Iowa Corn Crop Summary: Quantity and Quality

• Quantity above trendline

• Quality
  – Wet: >20%M, some much greater
  – Light: Test Weight ~ 52 lb/bu, no increase
  – Low protein: <7.5% (15%M)
  – Storage time: ~2/3 normal, maybe less
  – Damage: ~ 3-5%, normal = 1-2%
Iowa Soybean Crop Summary: Quantity and Quality

• Quantity above trendline
• Quality
  – Wet: >14% M, some much greater (20%)
  – Somewhat low protein: <35% (13%M)
  – Storage time: ~2/3 normal, maybe less
Weather Events and Quality

- West of I35: Reasonable planting dates
- East of I35: Progressively later
- Reduced heat units over summer
  - Delayed development rates but total good
  - Assured wet corn but...
- Warm late Aug, early Sep.
  - Brought crops along (Could have been worse!!)
  - Cost 2-3 lbs of test weight
Weather Events and Quality

• Then a slow cool late Sep/Oct.
  – Put the brakes on drydown
  – Created wet soybeans
  – 20-30% corn

• Then a warmer November
  – Bailed out the soybeans (field or bin)
  – Some help to the corn (~20-23%)

And now everything is frozen ...?
Soybean Drying Anyone?
Hail damage, Sac County, 8-09-2009

Photos courtesy: Mark Licht, ISU Extension
Ear rot assessments – percent severity; rot present

Cladosporium

Gibberella

Fusarium

Penecillium

Fusarium

Trichoderma
# Ear Rot Summary

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>High</th>
<th>Low</th>
<th>Ear rot*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hail samples</strong> (N=63)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ear rot severity (%)</td>
<td>11.3</td>
<td>53.4</td>
<td>0.0</td>
<td>Fusarium, Gibberella</td>
</tr>
<tr>
<td><strong>Background samples</strong> (N=26)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ear rot severity (%)</td>
<td>3.2</td>
<td>16.4</td>
<td>0.0</td>
<td>Cladosporium</td>
</tr>
</tbody>
</table>

* Predominant ear rots present
Ear rot severity (%) increased with greater hail damage (%)

\[ y = 2.198x + 2.8098 \]

\[ R^2 = 0.6678 \]
Hail damage at Milk Stage increases ear rot

<table>
<thead>
<tr>
<th>Stage</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 (silking)</td>
<td>0.10</td>
<td>0.83</td>
<td>0.91</td>
</tr>
<tr>
<td>R2 (blister)</td>
<td>-0.56</td>
<td>0.83</td>
<td>0.51</td>
</tr>
<tr>
<td>R3 (milk)</td>
<td>1.46</td>
<td>0.66</td>
<td>0.03</td>
</tr>
<tr>
<td>R4 (dough)</td>
<td>0.91</td>
<td>1.00</td>
<td>0.37</td>
</tr>
<tr>
<td>VT tasseling</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Actions Now

• Do you know the moisture, test weight and temperature in every bin?
• Corn >20% M? Move or dry in January.
• Market by test weight.
• Expect 2/3 or less storage life.
• In Feb – remove some, check, relevel.
• Increase in temperature? Act now.
• Feed on farm? Test your corn; toxins, protein
Typical Ethanol Corn Specs

- Base US Grade #2 Yellow Corn
- Moisture limit: 17% (a few take 18%)
- Test Weight low limit: 54 lb/bu
- Damage limit: 10% max (discount from 5%)
- Broken Corn: 12% max
- Toxins: <1/3 FDA guidance/action level

Source: Hardy et al 2006.
<table>
<thead>
<tr>
<th>Hail</th>
<th>Total No. samples</th>
<th>No. positive</th>
<th>Mean</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>DON</td>
<td>Yes</td>
<td>55</td>
<td>54</td>
<td>1.71</td>
<td>&gt;6.0</td>
</tr>
<tr>
<td>(ppm)</td>
<td>No</td>
<td>5</td>
<td>3</td>
<td>0.67</td>
<td>2.4</td>
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<tr>
<td>ZEN</td>
<td>Yes</td>
<td>55</td>
<td>43</td>
<td>0.31</td>
<td>&gt;1.4</td>
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<tr>
<td>(ppm)</td>
<td>No</td>
<td>5</td>
<td>2</td>
<td>0.02</td>
<td>0.04</td>
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<tr>
<td>Fum</td>
<td>Yes</td>
<td>55</td>
<td>40</td>
<td>0.25</td>
<td>4.8</td>
</tr>
<tr>
<td>(ppm)</td>
<td>No</td>
<td>5</td>
<td>3</td>
<td>0.05</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Visual count and severity - best indicators

DON vs Percent hail damage, ear rot severity (%)

- DON, ppm
- Damage (%); Severity (%)

\[ y = 0.2758x + 1.3988 \]
\[ R^2 = 0.2791 \]

\[ y = 0.1431x + 1.078 \]
\[ R^2 = 0.5126 \]

- Hail damage (%)
- Ear rot severity (%)

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University Extension
DON and ZEN present in hail samples

Vomitoxin (DON) and Zearalenone (ZEN), Hail Study Corn 2009

--- Test Kit Limits ---

-- Ethanol plant limit
NIRS-Based Equation for Ethanol Yield

0.1 gal/bu = $6,000,000/yr (100 mgy plant)

Predicted ethanol yield against reference ethanol yield for final Protein-Oil-Density equation

<table>
<thead>
<tr>
<th>Component</th>
<th>Final Equation Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>3.23</td>
</tr>
<tr>
<td>Protein</td>
<td>-0.062</td>
</tr>
<tr>
<td>Oil</td>
<td>-0.030</td>
</tr>
<tr>
<td>Density</td>
<td>0.104</td>
</tr>
</tbody>
</table>
Converted to percent of maximum yield
Normalized for location differences

Compiled percent maximum grain yield vs. planting date for 3 northern Iowa locations

\[ y = -0.0002x^2 + 17.382x - 343915 \]
\[ R^2 = 0.9241 \]
Planting Date – Ethanol Yield

Percent maximum ethanol yield vs. planting date for 3 Northern Iowa locations - 2008

\[ y = -7 \times 10^{-6}x^2 + 0.5397x - 10676 \]

\[ R^2 = 0.6331 \]
Economic Loss

$0.05 loss per bushel

100 million gallon per year ethanol plant

- 2.8 gal/bu
- 35,714,286 bushels/year
- $1.79 million loss in ethanol production due to corn quality
- Plus cost to acquire additional grain

Note: $2.77 million 12/2009

Economic Loss Due to Corn Quality Compiled Northern Iowa Locations

<table>
<thead>
<tr>
<th>Planting Date</th>
<th>$/bu loss of ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>0.01</td>
</tr>
<tr>
<td>3</td>
<td>0.01</td>
</tr>
<tr>
<td>4</td>
<td>0.02</td>
</tr>
<tr>
<td>5</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Ethanol Price March 2009 = $1.42/gal

Iowa State University Extension model ‘Ethanol Profitability’, 2009
A Tough Harvest - Frequently Asked Questions, Update (11/20/2009)
A Tough Harvest - Frequently Asked Questions (11/1/2009)
Soybean Quality Issues in 2009 (10/19/2009)
2009 Corn Quality Issues (10/15/2009)
2009 Corn Quality Issues – Storage Management (10/15/2009)
2009 Corn Quality Issues – Field Molds (10/15/2009)
Quality Issues Related to Hail Damaged Crops (9/10/2009)

Where to find us...

www.iowagrain.org