Crop Quality and Grain Storage Management

The ISU Extension Grain Management Team
Charles Hurburgh, Shawn Shouse, Greg Brenneman
Agricultural Engineering

Kelvin Leibold, Steve Johnson
Farm Management

Mark Licht: Agronomy

Alison Robertson: Plant Pathology
OUTLINE

• Crop quality – learning from history
  - 2009 Corn Issues
  - 2010 Weather and Quality
  - 2011 Weather and Quality

• Basic inventory management practice

• Future issues
Wet Corn!
Hail damage, Sac County, 8-09-2009

Photos courtesy: Mark Licht, ISU Extension
Ear rot assessments – percent severity; rot present
Corn, NE Iowa, January 2010
## Ear Rot Summary

<table>
<thead>
<tr>
<th>Total Damage</th>
<th>Mean ear rot severity (%)</th>
<th>Ear rots present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Range)</td>
<td></td>
</tr>
<tr>
<td><strong>Hail damage samples</strong></td>
<td>11.8</td>
<td>Fusarium*</td>
</tr>
<tr>
<td>((N=56))</td>
<td>(0 – 53.4)</td>
<td>Gibberella*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cladosporium, Penecillium</td>
</tr>
<tr>
<td><strong>Background samples</strong></td>
<td>3.3</td>
<td>Cladosporium*</td>
</tr>
<tr>
<td>((N=27))</td>
<td>(0 – 16.4)</td>
<td>Fusarium, Gibberella</td>
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<tr>
<td><strong>Standing corn samples</strong></td>
<td>24.0</td>
<td>Cladosporium*</td>
</tr>
<tr>
<td>((N=72)) ((No increased toxin))</td>
<td>(0.2 - 83.8)</td>
<td>Fusarium, Gibberella</td>
</tr>
</tbody>
</table>

* Predominant ear rot present

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Iowa State University  
University Extension
### Maximum storage time (months) for corn and soybeans*

<table>
<thead>
<tr>
<th>Corn temperature °F</th>
<th>Corn, soybeans moisture content</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>13%, 11%</td>
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<tr>
<td>40</td>
<td>150</td>
</tr>
<tr>
<td>50</td>
<td>84</td>
</tr>
<tr>
<td>60</td>
<td>47</td>
</tr>
<tr>
<td>70</td>
<td>26</td>
</tr>
<tr>
<td>80</td>
<td>15</td>
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</table>

*Based on 0.5% maximum dry matter loss—calculated on the basis of USDA research at Iowa State University. Corresponds to one grade number loss; 2-3% pts in damaged seeds Soybeans approximated at 2% lower moisture than corn.

Reduce to half if TW < 52 lb/bu
Blue-eye; Penicillium or A. Glaucus
No Dry Air in July and August!
**EQUILIBRIUM MOISTURE CONTENT**

*Corn, yellow dent (Wet Basis)*

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>30%</th>
<th>35%</th>
<th>40%</th>
<th>45%</th>
<th>50%</th>
<th>55%</th>
<th>60%</th>
<th>65%</th>
<th>70%</th>
<th>75%</th>
<th>80%</th>
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<th>90%</th>
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<td>35°</td>
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<td>14.2</td>
<td>14.8</td>
<td>15.6</td>
<td>16.3</td>
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<td>18.2</td>
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<td>11.9</td>
<td>12.5</td>
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<td>14.5</td>
<td>15.2</td>
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<td>17.9</td>
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<td>11.5</td>
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<td>14.1</td>
<td>14.9</td>
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<td>17.6</td>
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<tr>
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<td>10.2</td>
<td>10.9</td>
<td>11.6</td>
<td>12.3</td>
<td>13.1</td>
<td>13.9</td>
<td>14.8</td>
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<td>17.2</td>
<td>18.9</td>
</tr>
</tbody>
</table>

Any time you have EMC balanced with 65% RH, Blue Eye is possible.
2010 – warm and wet

Iowa Environmental Mesonet
Map Generated 06 Sep 2010 7:01 AM

Iowa State Climate Office
Des Moines, Iowa

Total Precipitation: Percent of Mean
June 8, 2010 to September 5, 2010
Flooded Corn
In September and October, 2010 we had extremely dry air.
2011 Quality

- Heat unit accumulation +/- to normal
- Hot July = Early maturity, pollenation
- Dry weather - reduced fill but cooler. August was some buffer.
- **Corn:**
  - Lower kernel weight; fewer kernels.
  - Average+ TW except wilted, hail, frost, stalk rot
  - Moisture - mid to low teens; wetter east
  - Protein - highly variable; higher in dry areas

- **Soybeans:**
  - Mixed bag - small seeds but lots of them.
  - A few Green beans North, SW but dried fast.
  - Low protein and low oil
Inbound Grading

Moisture
- 0.1% Moisture = 1-3 cents/bu
- +/- 0.3% vs GIPSA
- More than just once a year
- Calibration update

Test Weight
- +/- 0.5 lb/bu vs GIPSA
- 1 lb/bu = 1.5% inventory error
- Cup? Training or worse than meter!
Accuracy of GAC2500 Moisture Meter, 2010 corn

\[ y = 0.9498x + 0.8096 \]

\[ R^2 = 0.9953 \]

\[ n = 200 \]

\[ sd = 0.34 \]
## Value of Shrink

<table>
<thead>
<tr>
<th>Shrink Percentage</th>
<th>Corn Value</th>
<th>Beans Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5%</td>
<td>$7.00</td>
<td>$14.00</td>
</tr>
<tr>
<td>1.0%</td>
<td>3.5 cents/bu</td>
<td>7 cents/bu</td>
</tr>
<tr>
<td>2.0%</td>
<td>7.0</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>14.0</td>
<td>28.0</td>
</tr>
</tbody>
</table>
Storage Management

Choose which grain for less flexible storage.

- Clean
- **Uniform moisture**; means has been aerated
- Higher test weight; as possible (56+ for corn)
- **From one crop year**
- No history of problems; under your control for as long as possible.

- **Sort on Test Weight.**
- Remove the center core.
Shrink – Handling and Storage

• Lost kernels, dust, mold, increased FM

• Some Estimates:
  – 0.5% (0.005) weight loss per in and out. Out to Pile counts double. More if multiple turns.
  – 0.2% FM Increase per rotation (15% corn); 0.4% if 13%, etc. More with dryer stress cracks or low TW (2x)
  – 0.5% weight loss per 3% pt damage increase.

• Example: 3% to 12% is 9% pts = 1.5% shrink
Aeration Phases

• Phase 1: Fall Cool Down
  • Lower grain temperatures stepwise
    • September 50-55 F!!!
    • October 40-45 F
    • November 35-40 F
    • December 28-35 F

• Phase 2: Winter Maintenance
  • Maintain temperatures with intermittent aeration
    • January, February 28-35 F

• Phase 3: Spring Holding
  – Keep cold grain cold
    • Seal fans
    • Ventilate headspace intermittently

Source: Purdue Univ.
Overall = 2.1 bu/a/yr; Last 10= 3.5 bu/a/yr; Seed industry = 4-6 bu/a/yr; +400-500 million bu/year Nitrogen use: 1.0-1.1 lb/bu down to 0.7-0.8 lb/bu
New Corn Storage as "105s"
"105" = 650,000 bu; 4 bu/acre/yr increase
FDA - Food Safety Modernization Act

- Update registration every two years
- A written food safety plan is required
- Carrier certification and examination (BSE)
- Surveillance inspection every 5-7 years

- Accuracy guidelines for enhanced traceability
- FDA now can force a recall
- Self reporting website apply to mycotoxins???
- Inspect records and audit without prior cause
First Actions

- **Train new inspectors**, visit facilities
- Emphasis on food safety plans – FEED!
- Specific audits and checks in familiar areas; eg sanitation, BSE/meat products
- Traceability/recall – ask state of the art
- Wild card: Moldy grain and mycotoxins
- Third party audits – fading reputation
Coal

Asbestos

Glass

Dead vermin
Summary

• Variable weather outlook will increase grain management problems.
• Probably new issues never seen before.
• Challenges of volume despite known science.
• Higher value rewards precise management.
• Food safety regulations will apply.
Where To Find Us...

- Iowa Grain Quality Initiative
- Grain Quality Laboratory
- www.iowagrain.org
- www.grainlab.org

Supporting Services and Technologies for BioProcess Industries

Analytical Programs
Quality Management
Systems

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