Grain Quality Management for the 2013 Harvest

Grain Journal Webinar
November 18, 2013

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www.grains.k-state.edu
Preharvest Outlook for Grain Quality:

2013 Crop

Dr. Charles Hurburgh
Agricultural Engineering
September 16 and 17, 2013

http://www.abe.iastate.edu/extension-and-outreach/grain-quality/
www.iowagrain.org
Corn Quality –2013

• **Hot and Dry: Most Likely Now**
  – Small kernels, low test weight (52-54 lb/bu)
  – Poor storage properties – **high variability**
  – Low and high test weight: root development

• **Hot and Wetter: Mostly Too Late Now**
  – Bigger kernels, normal+ test weight, wet corn?
  – Ok storage properties; still mixed quality

  **Moisture and Test Weight variations:**
  More fines, inconsistent drying, wetter corn in bins.

http://www.abe.iastate.edu/extension-and-outreach/grain-quality/
www.iowagrain.org
Average moisture content (MC), moisture content range, percentage point differential, and standard deviation (SD) in maize kernels collected at the inlet and outlet of commercial crossflow (CF), concurrent-flow (CCF), and mixed-flow (MF) dryers. (Source: Montross et al. 1994)

<table>
<thead>
<tr>
<th>Dryer Type</th>
<th>Average MC (%)</th>
<th>MC Range (%)</th>
<th>Point Differential</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In</td>
<td>Out</td>
<td>In</td>
<td>Out</td>
</tr>
<tr>
<td>CF</td>
<td>20.8</td>
<td>15.0</td>
<td>10.0 – 33.1</td>
<td>8.5 – 31.5</td>
</tr>
<tr>
<td>CCF</td>
<td>21.7</td>
<td>14.7</td>
<td>14.5 – 37.5</td>
<td>7.0 – 34.0</td>
</tr>
<tr>
<td>MF</td>
<td>22.4</td>
<td>14.8</td>
<td>8.5 – 38.5</td>
<td>8.0 – 35.5</td>
</tr>
</tbody>
</table>
Soybean Quality –2013

- **Hot and Dry: Most Likely Now**
  - Small beans, dry beans?, low protein
  - So late in planting…may still have some frost risk

- **Hot and Wetter: Not Likely Now**
  - Bigger beans, wetter beans, frost risk, composition?

Late growth: Green stems and mixed quality
New moisture meter: +1-2% on green beans
Frost: Aerate for 2-4 weeks.

http://www.abe.iastate.edu/extension-and-outreach/grain-quality/
www.iowagrain.org
http://cornandsoybeandigest.com/equipment/drying-cost-vs-harvest-loss
Aspergillus Ear Rot (photo © Gary Munkvold)

Gibberella Ear Rot
(Photo Courtesy of: A. Robertson)

Fusarium Ear Rot - fumonisins
(photo © Gary Munkvold)

All the molds in one place!
Sac County, Iowa. August 9, 2009

Penicillium species produce ochratoxins
(Photo: Don White, University of Illinois)

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www.iowagrain.org
Growth of *Aspergillus glaucus* in Corn
32°C (90°F), 15 % Moisture Content

- Spores per Gram of Corn
- Percentage of Kernels Infected

Weeks

Growth of *Aspergillus glaucus* in Corn
32°C (90°F), 15 % Moisture Content

Spores per Gram of Corn

- 0.0E+00
- 5.0E+06
- 1.0E+07
- 1.5E+07
- 2.0E+07

Percentage of Kernels Infected

- 0
- 25
- 50
- 75
- 100

Weeks

- 0
- 2
- 4
- 6
- 8

Spores

Infection

Kansas State University
Department of Grain Science and Industry
S.L.A.M. Step 1: Sanitation

- Handling equipment
- Transportation vehicles
- Storage structures
  - inside and outside
- Pest prevention
  - “Sanitation is pest control!”
  - Residual protectants
**S.L.A.M. Step 2: Loading**

- Screening/Pre-cleaning
- Coring
  - single vs. multiple withdrawals
- Leveling
  - spreading (mechanical, gravity)
- Sealing
  - fans, leaks, cracks
Pre-Cleaning

Gravity Cleaner

Aspirated Cleaner

Rotary Cleaner
• Core of fines
  – Foreign Material (FM)
  – Broken grain
  – Weed seeds
Non-uniform Airflow Effect - Peaked Grain Mass
Aeration Cooling Effect - Peaked Grain Mass

Day 7
Aeration Cooling Effect - Cored Grain Mass

Day 7

T

80°F
71°F
62°F
53°F
44°F
35°F

Day 7
Coring

One time coring

- Eliminate grain peak
- Remove core of BCFM
- Improve airflow through center
- Better monitor grain surface
S.L.A.M. Step 3: Aeration
Cool Grain to Prevent Storage Problems

- Optimum for Insects and Spoilage
- Insect Reproduction Reduced
- Insects Dormant
- Insects Killed

Grain Temperature

Temperature (F)

Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July

Temperatures for Upper Midwest

* Prevent crusting due to moisture migration by cooling grain to within 15°F of average outdoor temperatures.
* Cooling grain by 10°F doubles its allowable storage time
Aeration Phases

• Phase 1: Fall Cool Down
  – Lower grain temperatures stepwise
    • 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
Open Fan

Sealed Fan
Headspace Ventilation
135,000 bu Bin of Corn during Summer Storage in Indiana – Non-aerated on 7/28/89
Insect Cage Emergence - Field

- **80-85°F**
- **70-75°F**
- **60-65°F**

Comparison of insect emergence across different temperature ranges and months.

- **Control**
- **Ambient**
- **Chilled**

Legend:
- Blue: Month 1
- Yellow: Month 2
- Red: Month 3
- Black: Month 4
Summer Aeration

Should cooled grain be warmed up again?

NO!
University of Minnesota Fan Selection for Grain Bins

**Background**

**Settings**

**Bin and Crop Inputs**

- **Select a crop:** Barley
- **Floor Type:** Full
- **Bin Diameter, feet:** 21
- **Grain Depth, feet:** 20
- **Desired airflow (cfm/bu):** 1

**Estimated Fan Requirements**

(to get desired airflow when bin is full)

- **Bin capacity (bushels):** 5,542
- **Total airflow (cfm):** 5,542
- **Estimated static pressure (inches of water):** 7.12
- **Estimated fan power needed (hp):** 10.34

**Fan Selection**

- **Select a fan:** 0.33 hp AEROVENT 1240-DW | 12" (Axial)
- **Fan arrangement:** Parallel
- **Number of fans on bin:** 1

[http://webapps.bbe.umn.edu/fans/](http://webapps.bbe.umn.edu/fans/)
S.L.A.M. Step 4: Monitoring

- Temperature
- Moisture
- Molds
- Insects
  - present or absent
  - population growth
  - pest control (fumigation)
- Rodents
Use of handheld CO₂ sensor (Outdoor pile)
Foreign Grain Beetle

Mold Feeders

Hairy Fungus Beetle
Stored Grain Management Implications for 2013 Harvest

- Store grain at safe moisture content
- Core & level grain after loading bins
- Cool grain then seal fans
- Manage headspace conditions with intermittent ventilation
- Monitor grain regularly for insect activity and mold development
Grain Drying and Storage

- Corn and Soybean
- Drying
- Feed and Forage
- Links
- MWPS Publications
- Safety
- Publications

http://www.ag.ndsu.edu/graindrying
Professional Development Opportunity

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