U.S. Grains Council
Corn Export Cargo Quality Report
2014/2015

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Developing markets. >> Enabling trade. >> Improving lives.

Quality, Reliability, Transparency

Corn Export Cargo Quality Report 2014/2015

U.S. Grains Council:

- Building partnerships based on trust
- Bridge to world's largest, most reliable grain supply

Corn Quality Reports:

- Systematic survey of corn quality at harvest and of early exports
- Transparent and consistent methodology
- Reliable and comparable data

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Harvest Quality Report

Corn Export Cargo Quality Report 2014/2015

HARVEST QUALITY REPORT

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Export Cargo Quality Report

Corn Export Cargo Quality Report 2014/2015

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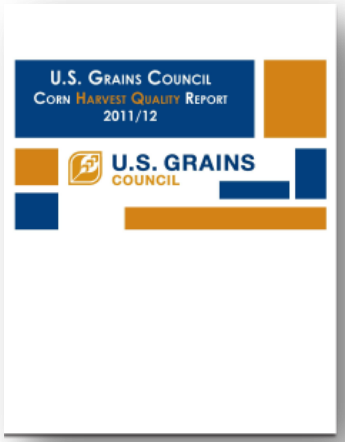
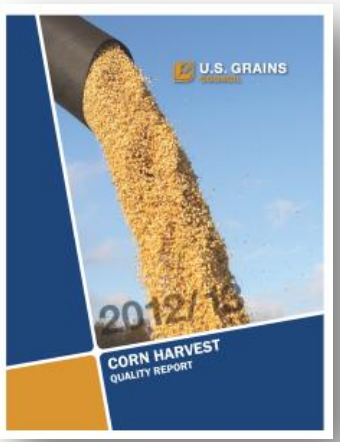
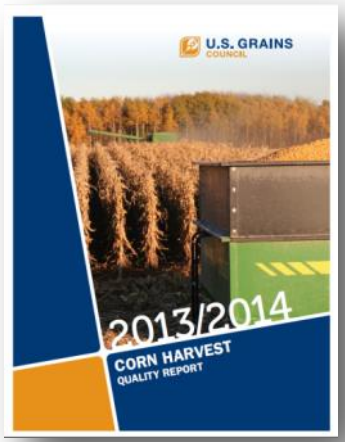
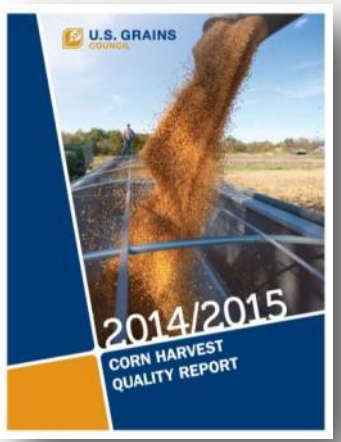
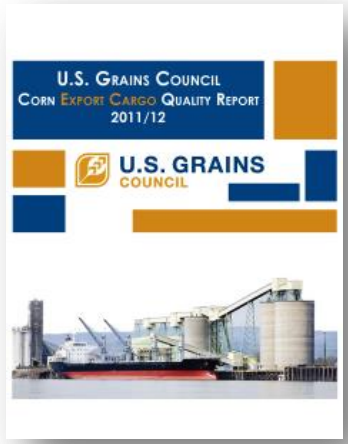
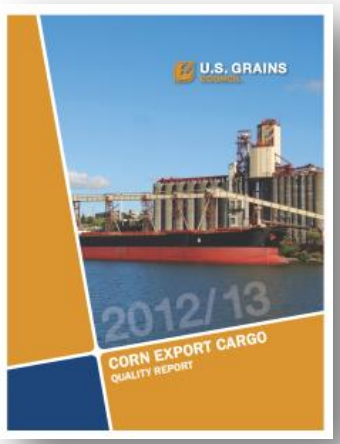
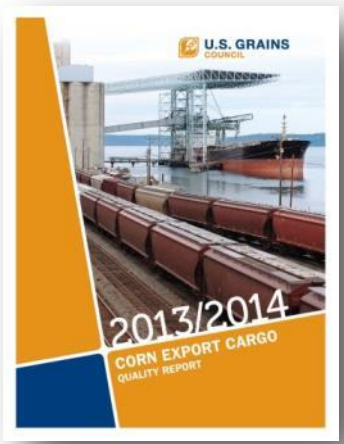
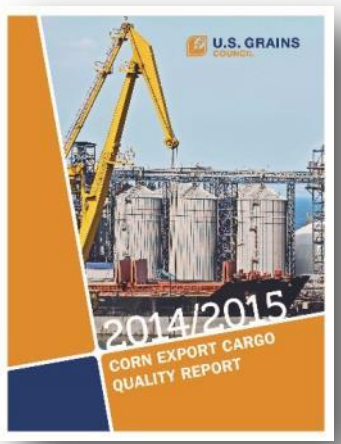
USGC Corn Quality Reports

Corn Export Cargo Quality Report 2014/2015

	2011/2012	2012/2013	2013/2014	2014/2015
Harvest				
Export Cargo				

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USGC Corn Quality "Export Catchment Areas" (ECA)

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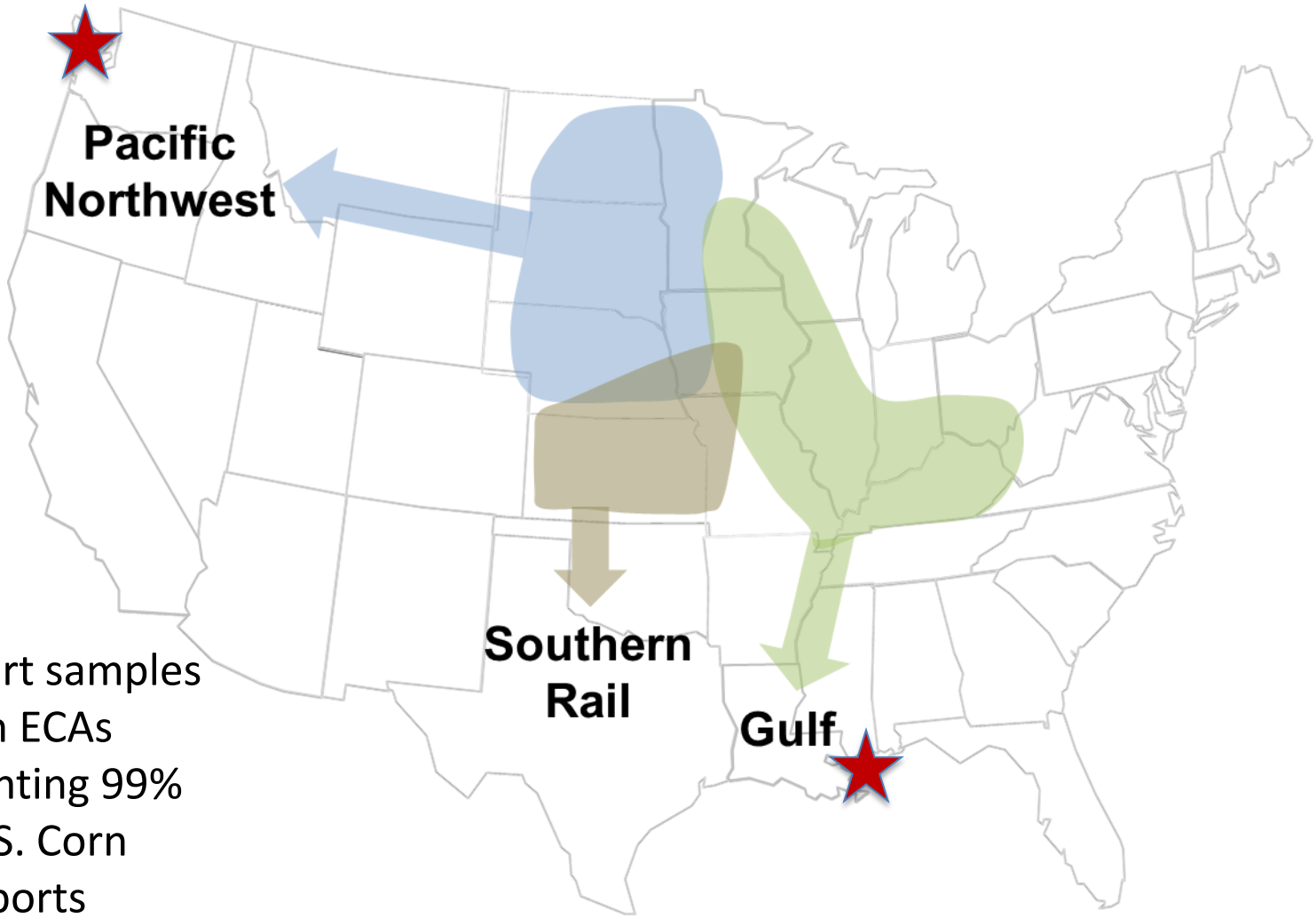

411 export samples from ECAs representing 99% of U.S. Corn Exports

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Quality Factors Tested

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Grade Factors

- Test weight
- Broken corn and foreign material
- Total damage
- Heat damage

Physical Factors

- Stress cracks/Stress crack index
- 100-kernel weight
- Kernel volume
- True density
- Whole kernels
- Horneous (hard) endosperm

Moisture

Chemical Composition

- Protein
- Starch
- Oil

Mycotoxins

- Aflatoxins
- DON

Export Cargo 2014/2015 Highlights

- **Grade factors**:
  - Aggregate average better than or equal to U.S. No. 2 on all attributes
  - Test weight higher than 2013/2014
- **Moisture**: same as last year
- **Chemical composition (compared to 2013/2014)**:
  - Higher oil
  - Similar protein and starch
- **Physical attributes (compared to 2013/2014):**
  - Lower stress cracks
  - Larger kernel size and higher true density
  - Similar whole kernel and horneous endosperm percentages

Test Results: Comparison

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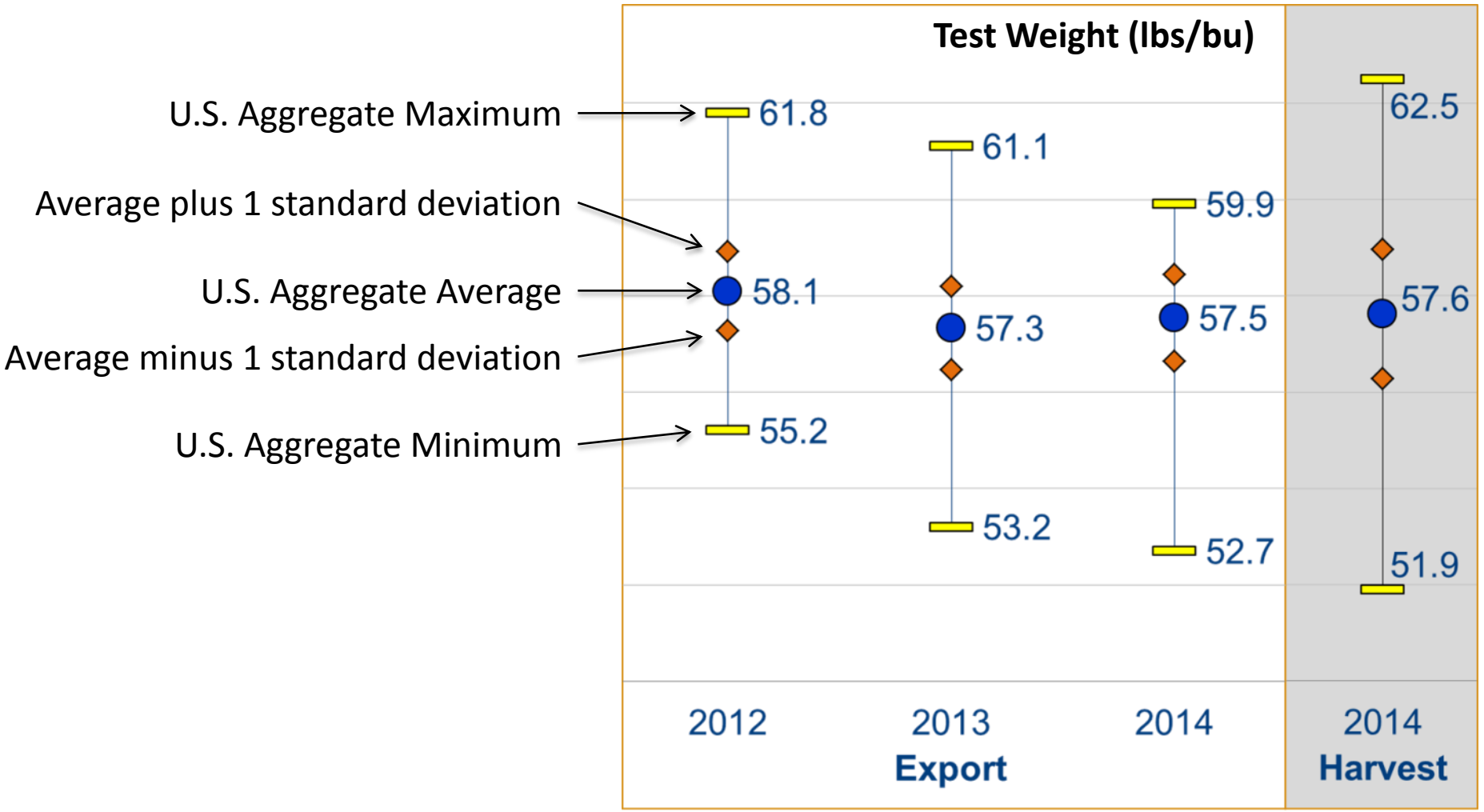

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Test Results: Comparison

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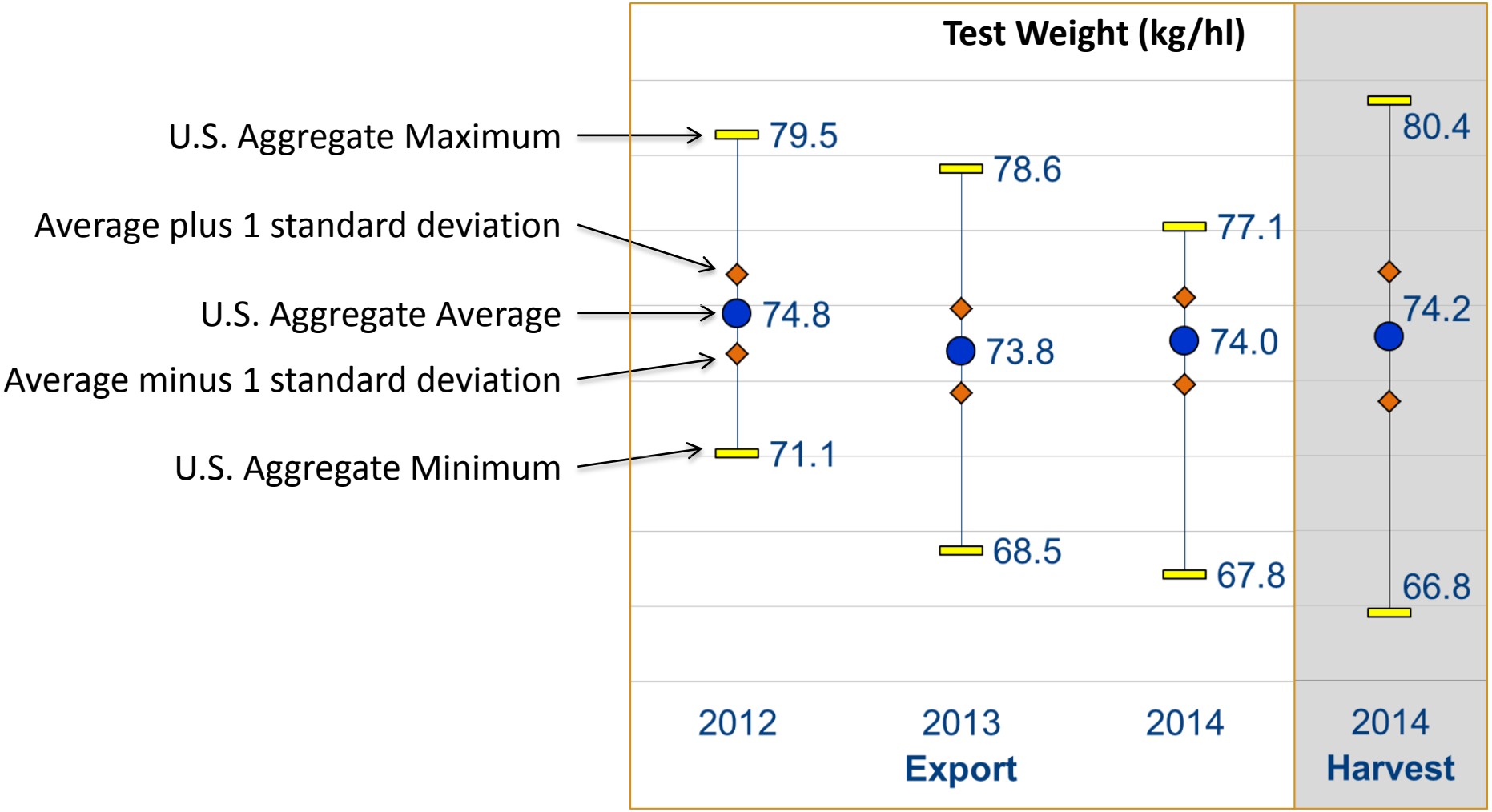

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Test Results: Comparison

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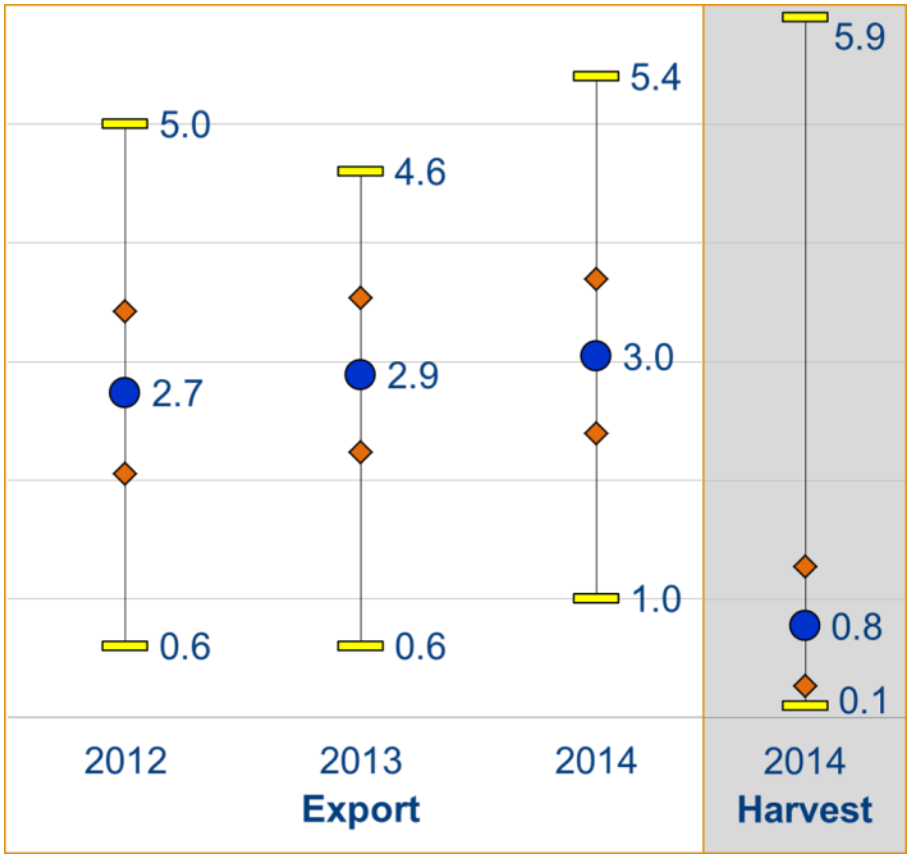
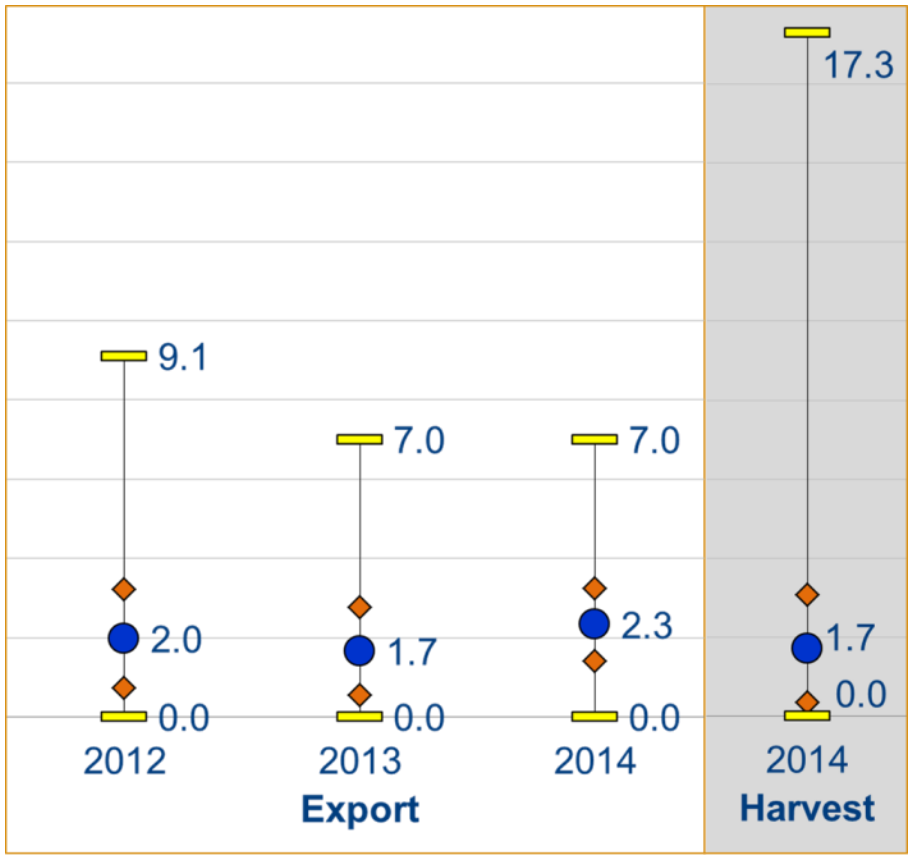
BCFM (%)



Total Damage (%)



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Test Results: Comparison

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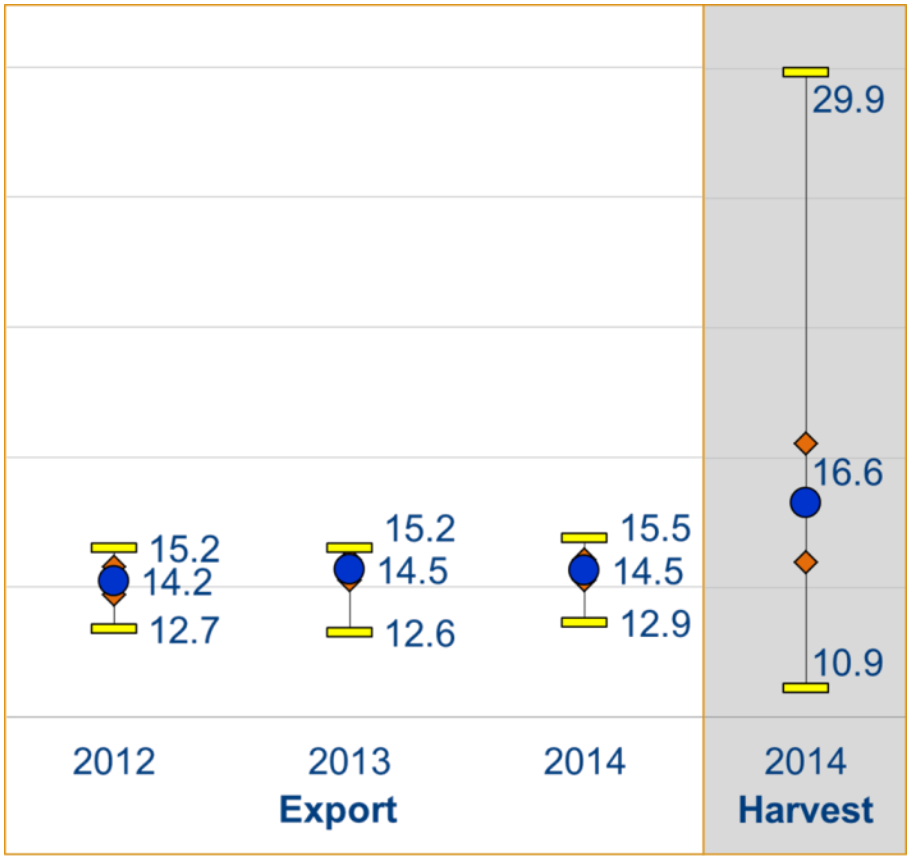
Moisture (%)



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Test Results: Comparison

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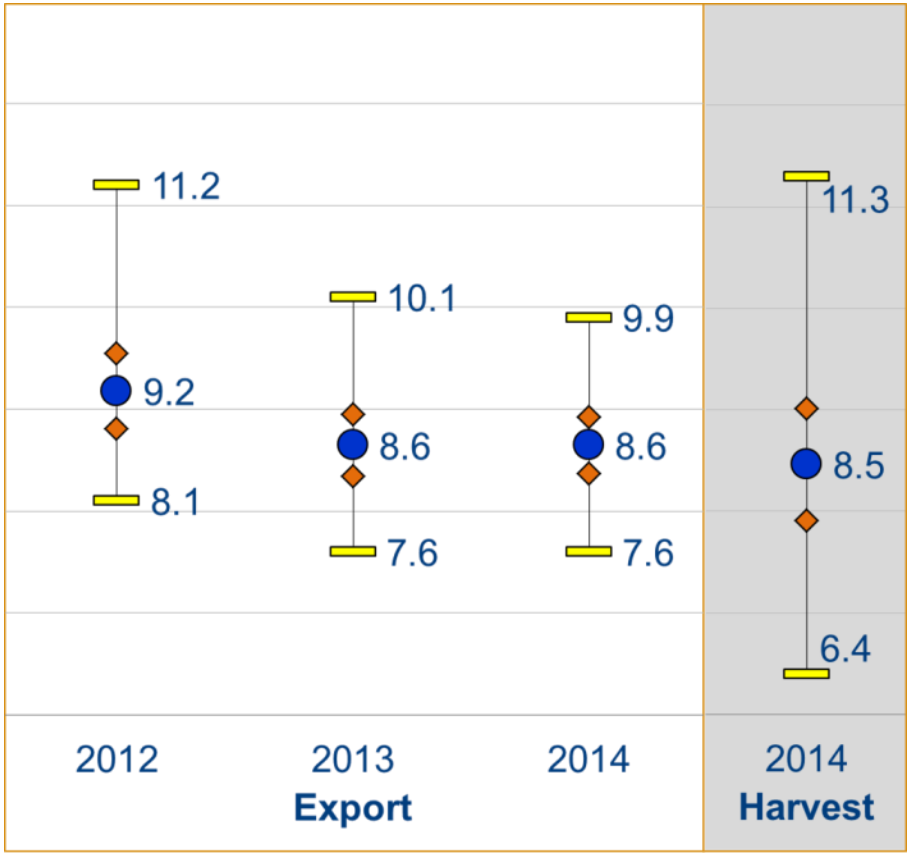
Protein (Dry Basis %)



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Test Results: Comparison

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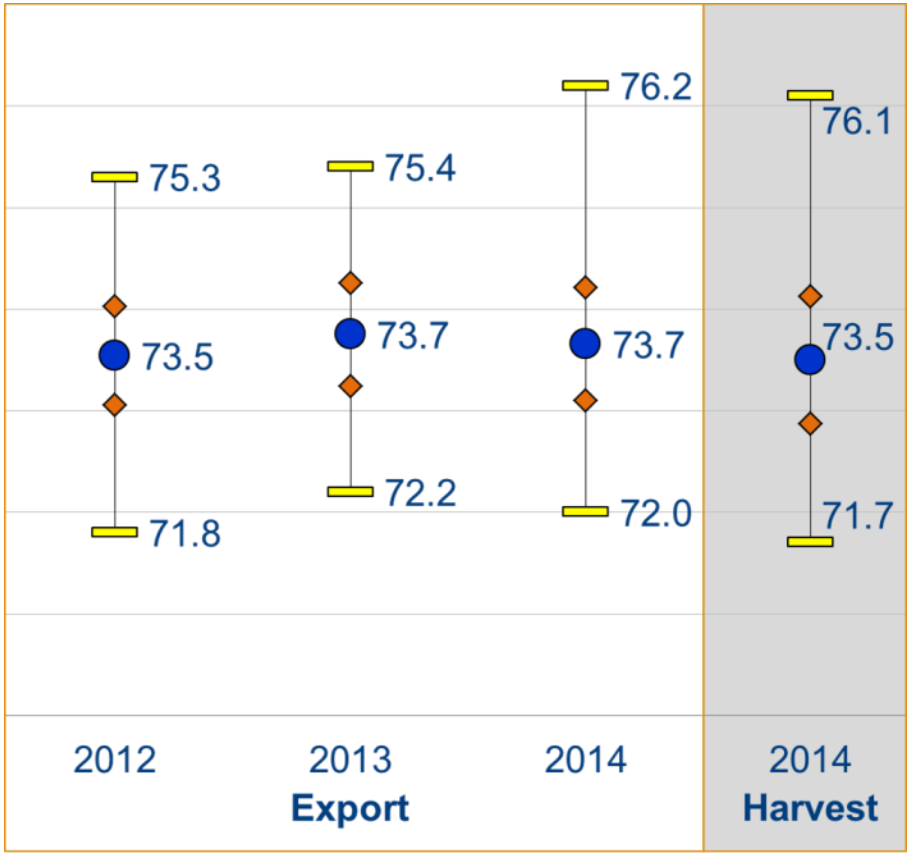
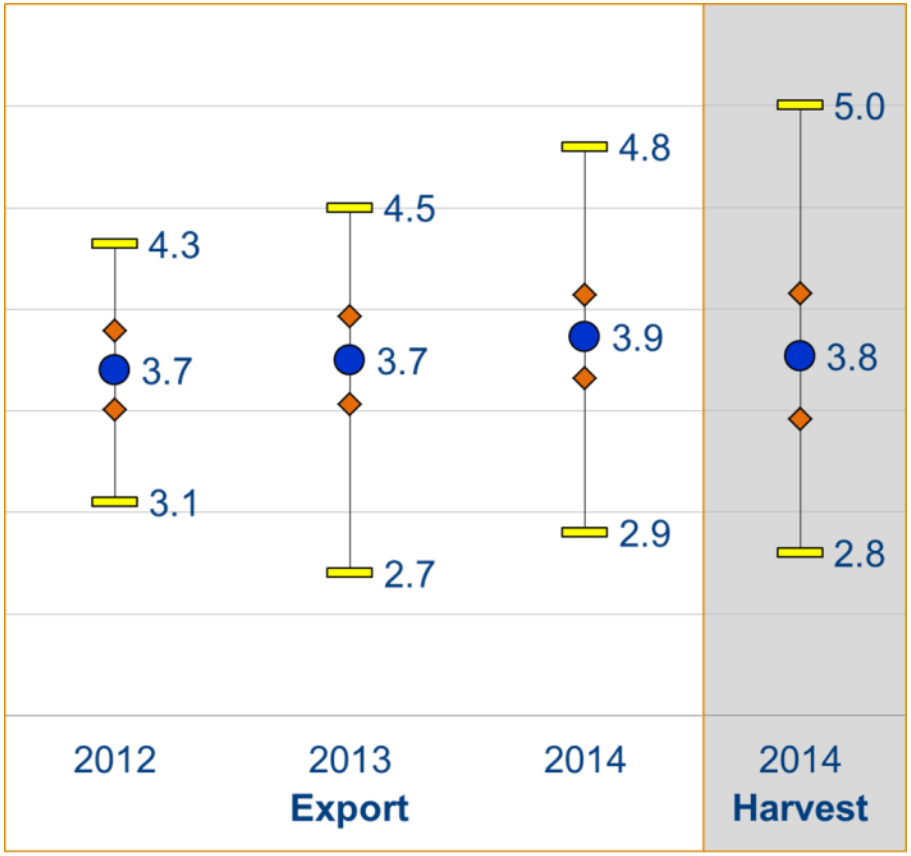
Starch (Dry Basis %)



Oil (Dry Basis %)



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Test Results: Comparison

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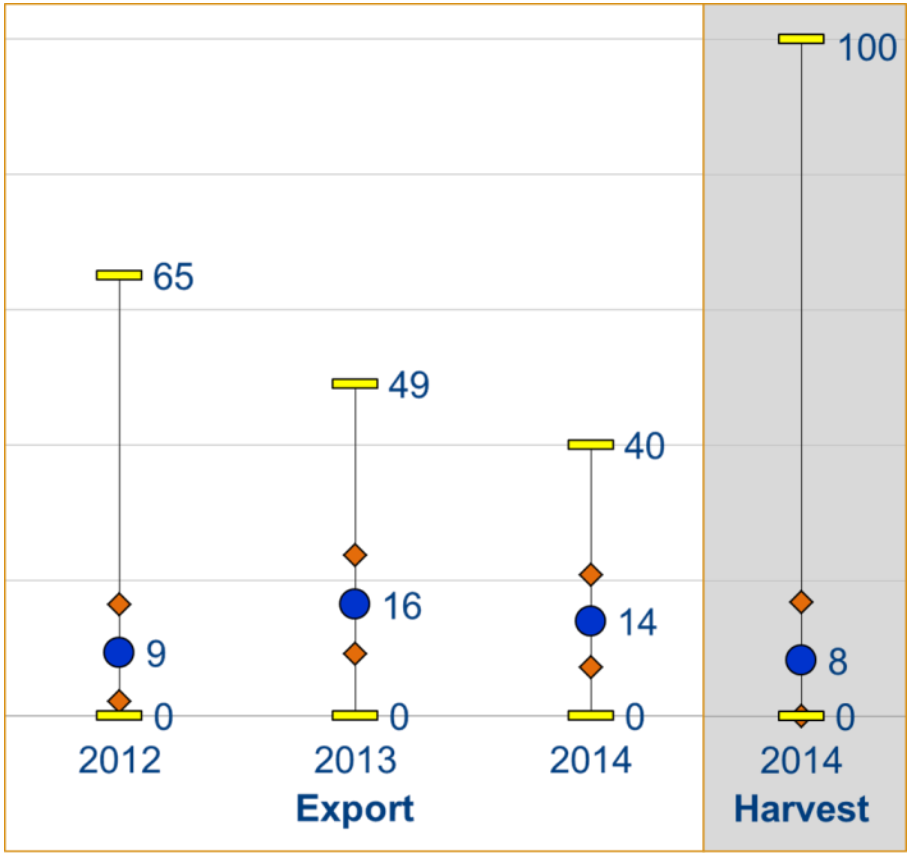
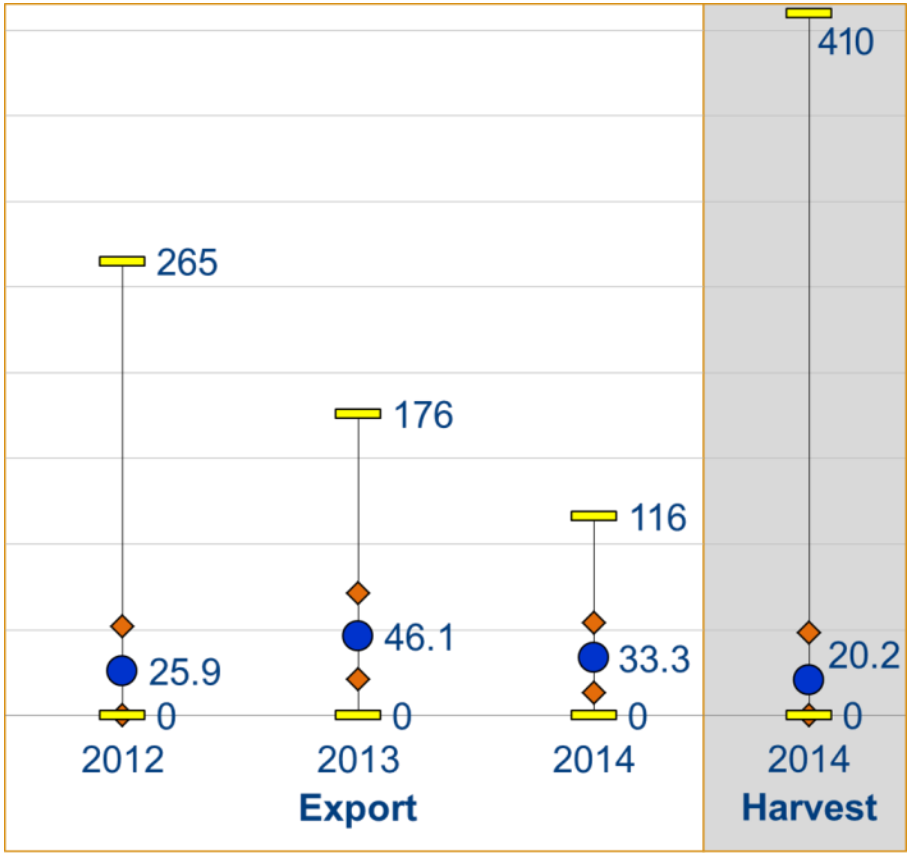
Stress Cracks (%)



Stress Crack Index



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Test Results: Comparison

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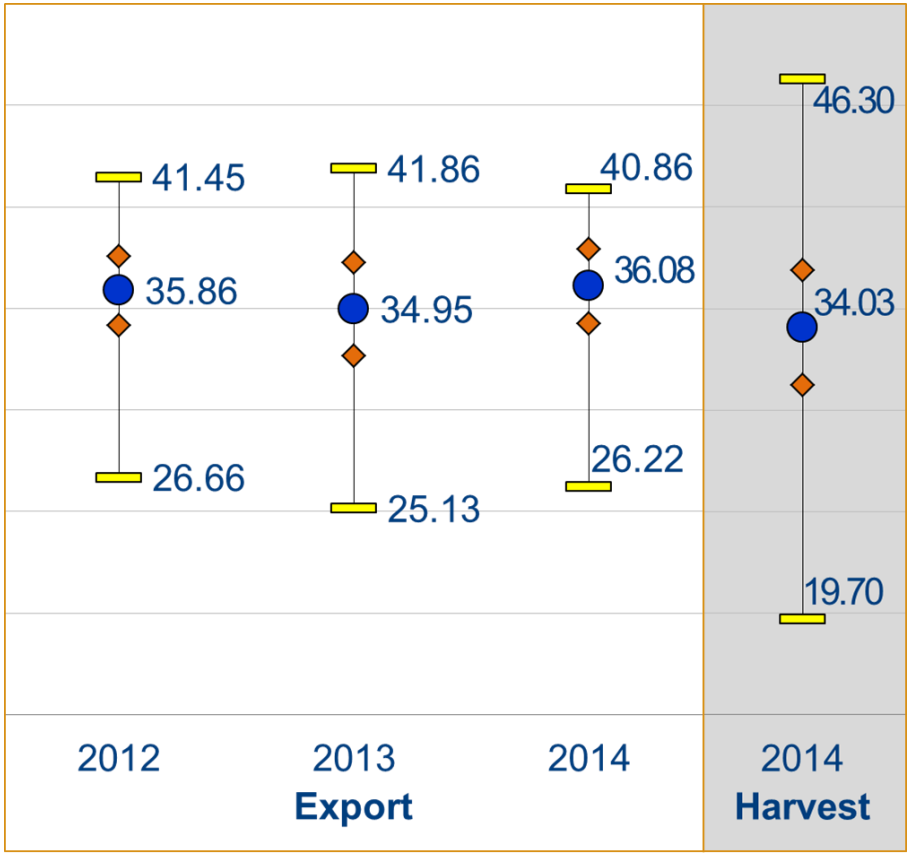
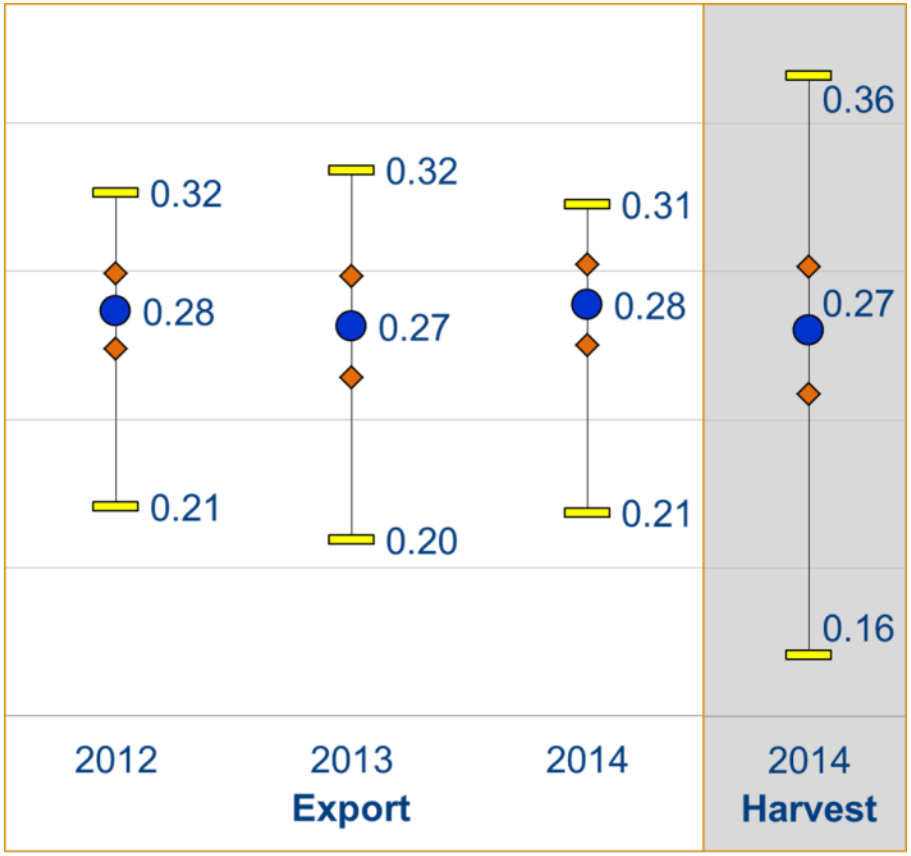
100-Kernel Weight (g)



Kernel Volume (cm^3)



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Test Results: Comparison

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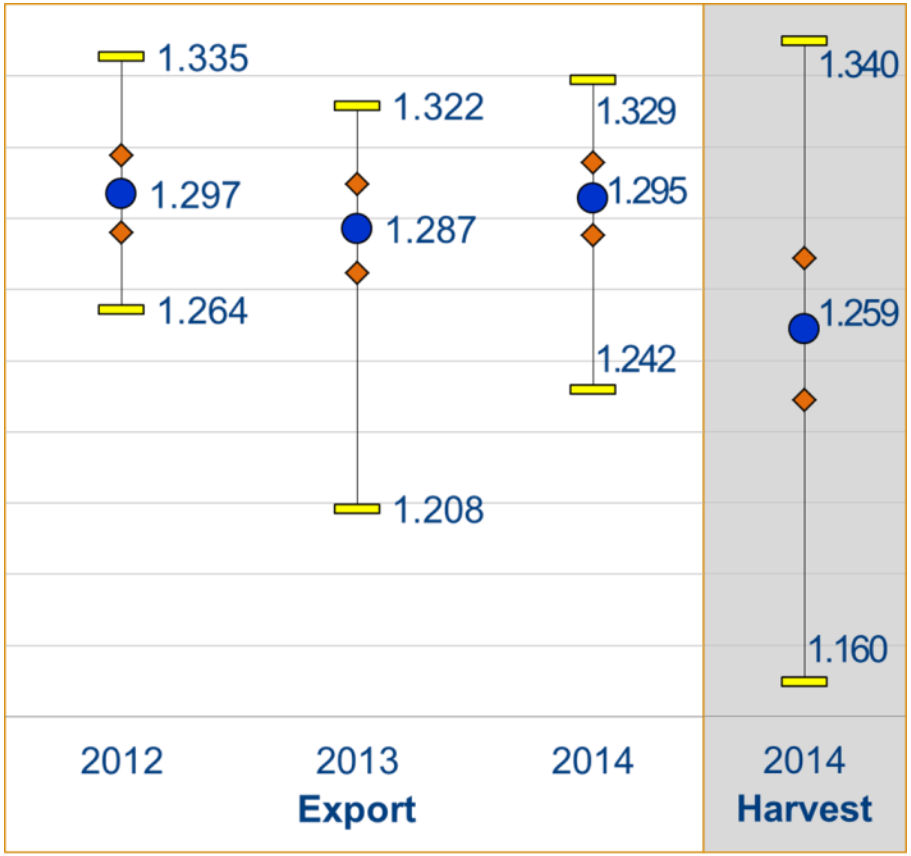
True Density (g/cm³)



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Test Results: Comparison

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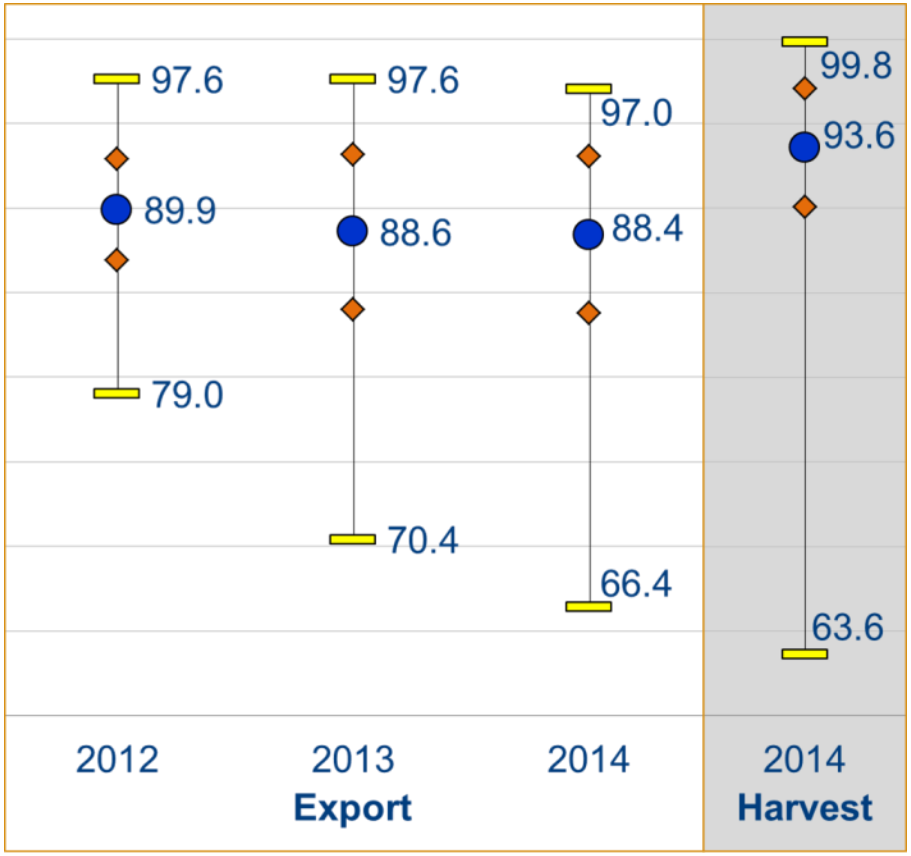
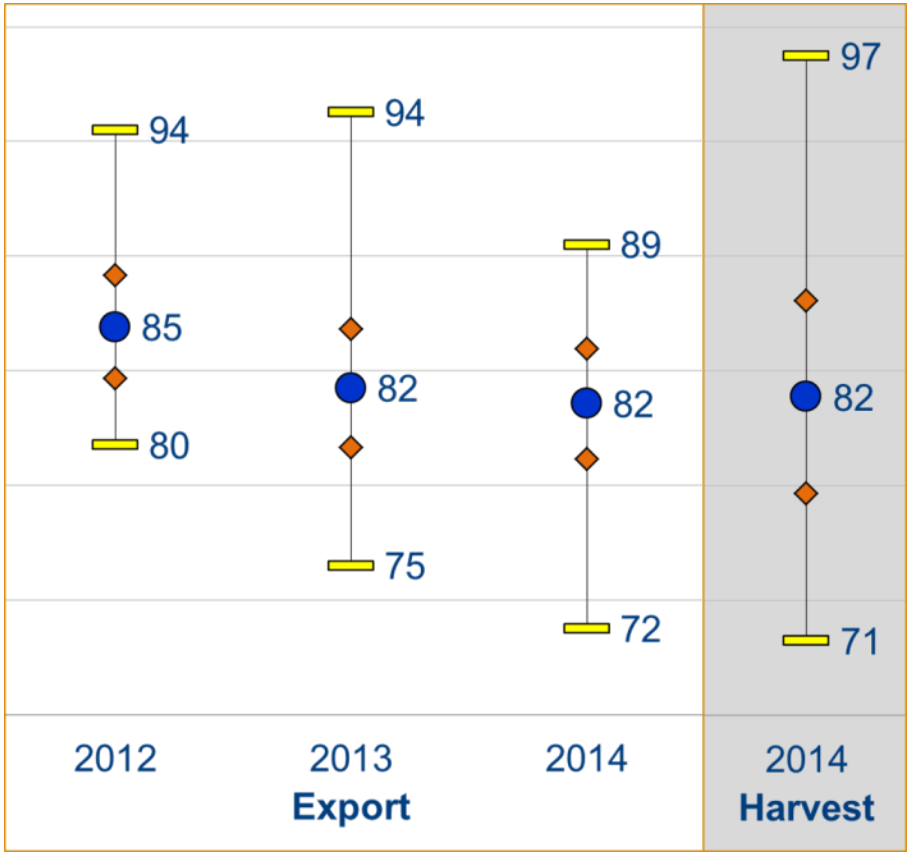
Whole Kernels (%)



Horneous (Hard) Endosperm (%)



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Test Results: Comparison (cont'd)

Aflatoxins

- Fewer incidents than 2012/2013 but slightly higher than 2013/2014

DON

- About the same incidents as 2013/2014 but slightly more than 2012/2013

Grade Factors and Moisture

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U.S. Corn Grades & Grade Requirements

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Grade	Test Weight (lb/bu)	Heat Damage (%)	Total Damage (%)	BCFM (%)
U.S. No. 1	56.0	0.1	3.0	2.0
U.S. No. 2	54.0	0.2	5.0	3.0
U.S. No. 3	52.0	0.5	7.0	4.0
U.S. No. 4	49.0	1.0	10.0	5.0
U.S. No. 5	46.0	3.0	15.0	7.0

Source: USDA Federal Grain Inspection Service (FGIS)

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Test Weight – U.S. Units

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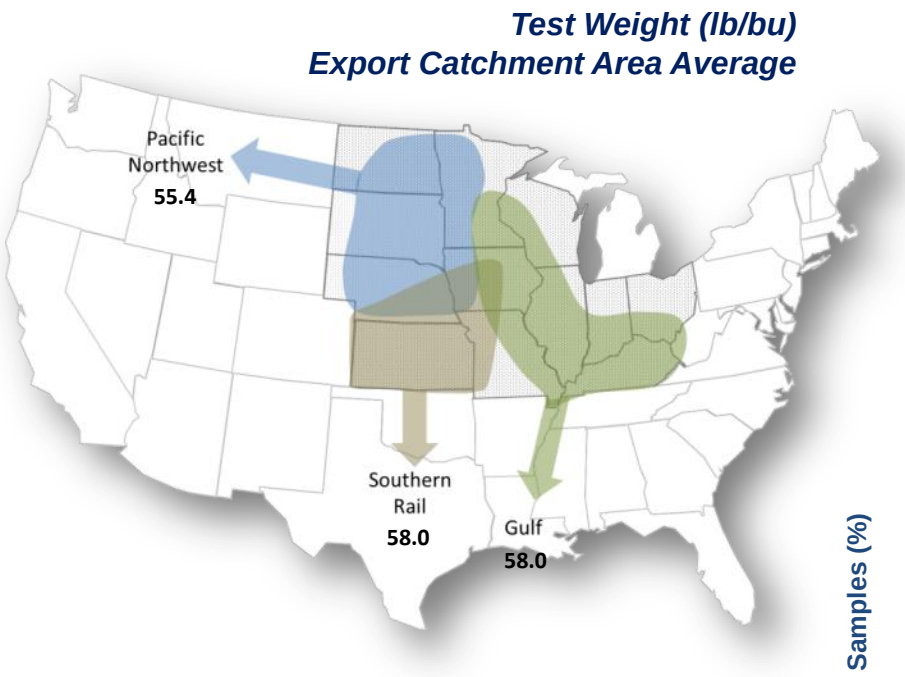
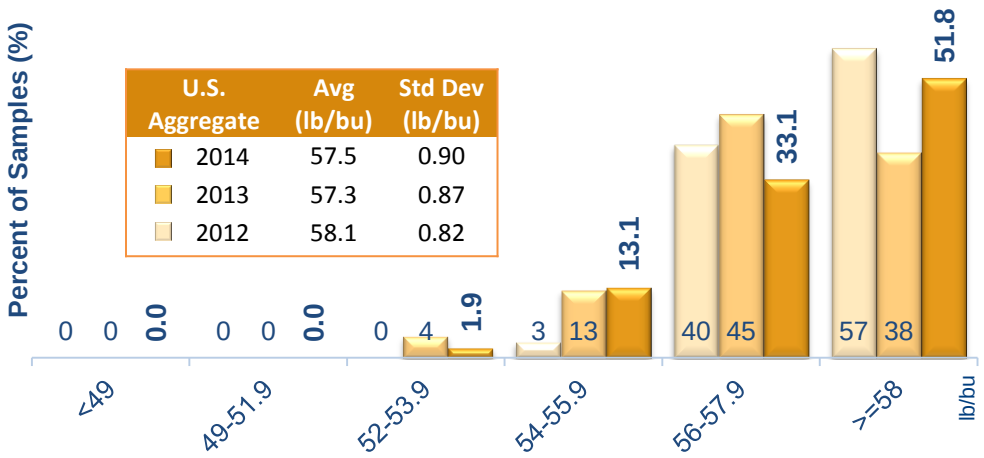


*3YA: simple average of U.S. Aggregate average quality factors in 2011/2012, 2012/2013, and 2013/2014

U.S. Aggregate: 57.5 lb/bu

- Indicates good overall grain quality
- Slightly lower than 3YA*
- Lower test weight in the PNW than other two ECAs



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Test Weight - Metric

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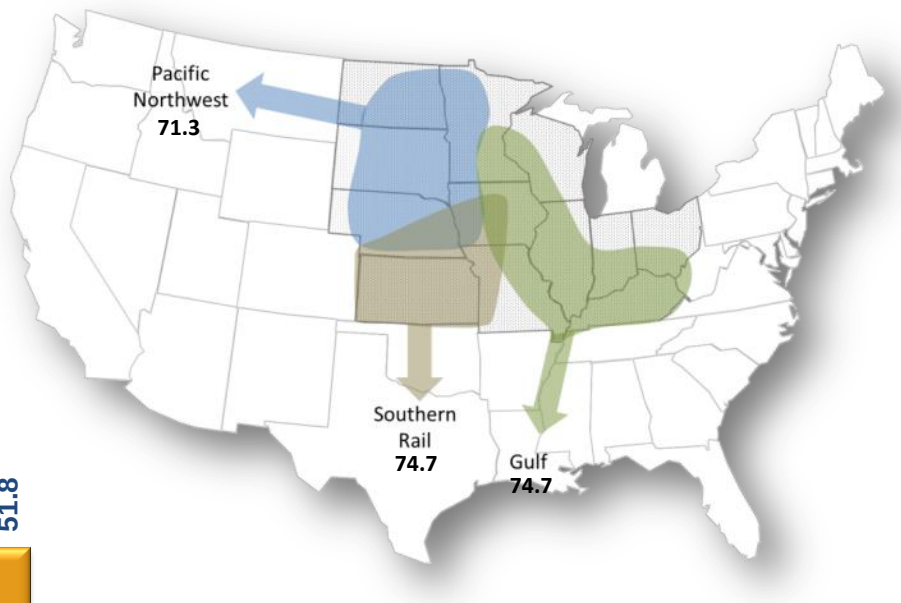
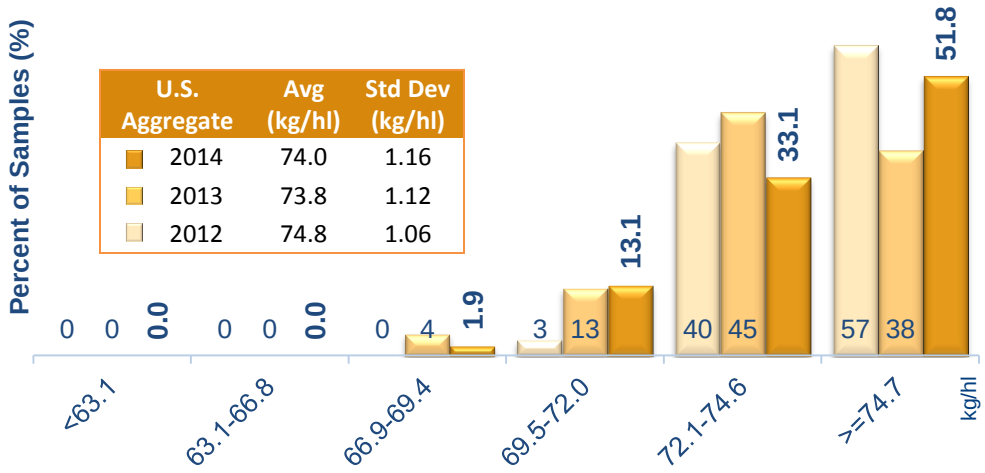
U.S. Aggregate: 74.0 kg/hl

- Indicates good overall grain quality
- Slightly lower than 3YA*
- Lower test weight in the PNW than other two ECAs

Test Weight (kg/hl)
Export Catchment Area Average





*3YA: simple average of U.S. Aggregate average quality factors in 2011/2012, 2012/2013, and 2013/2014

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Broken Corn/Foreign Material
Measured as % by weight

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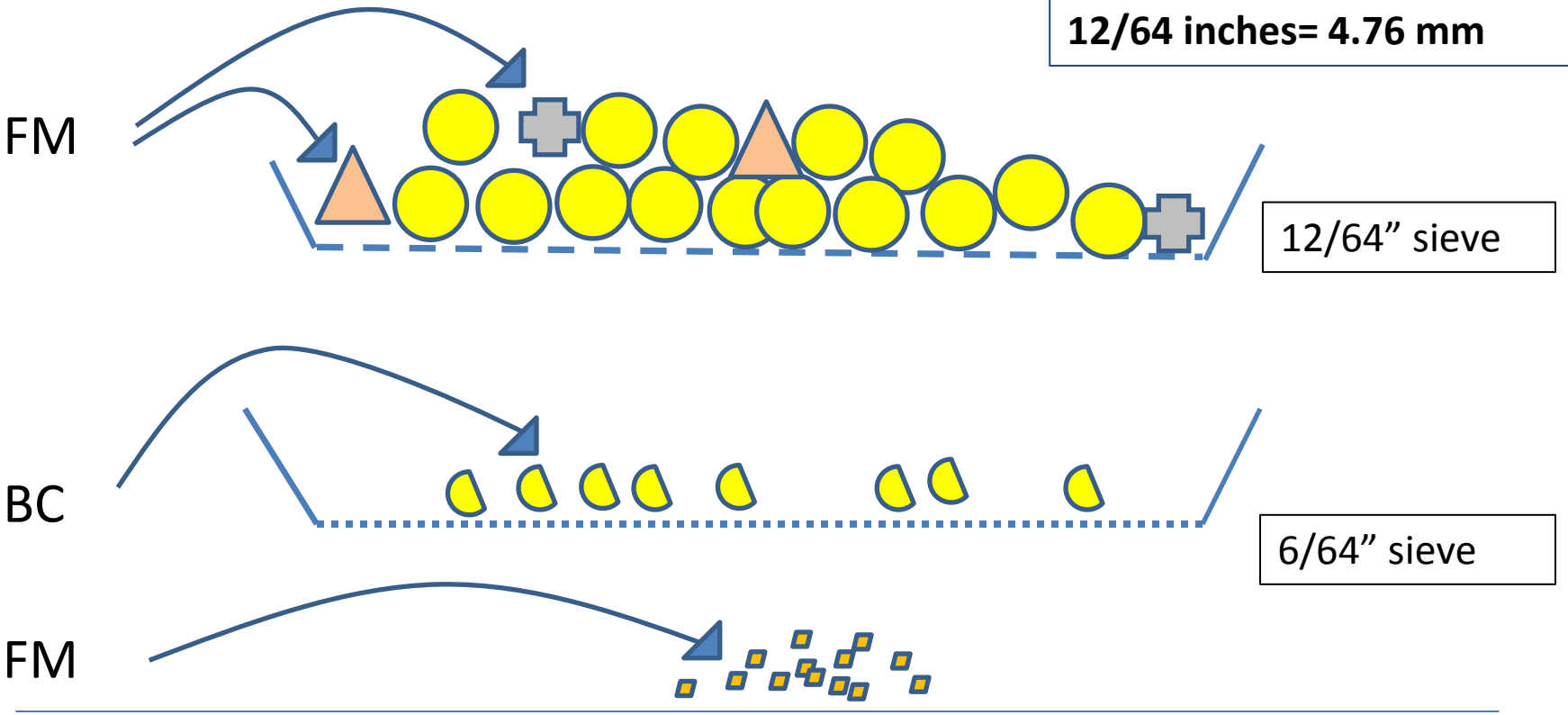
6/64 inches= 2.38 mm
12/64 inches= 4.76 mm



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Broken Corn and Foreign Material (BCFM) (%)

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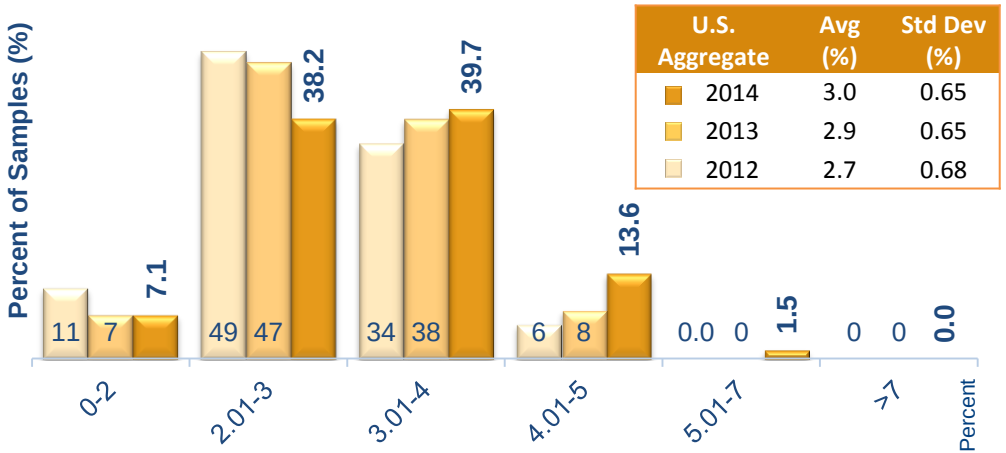
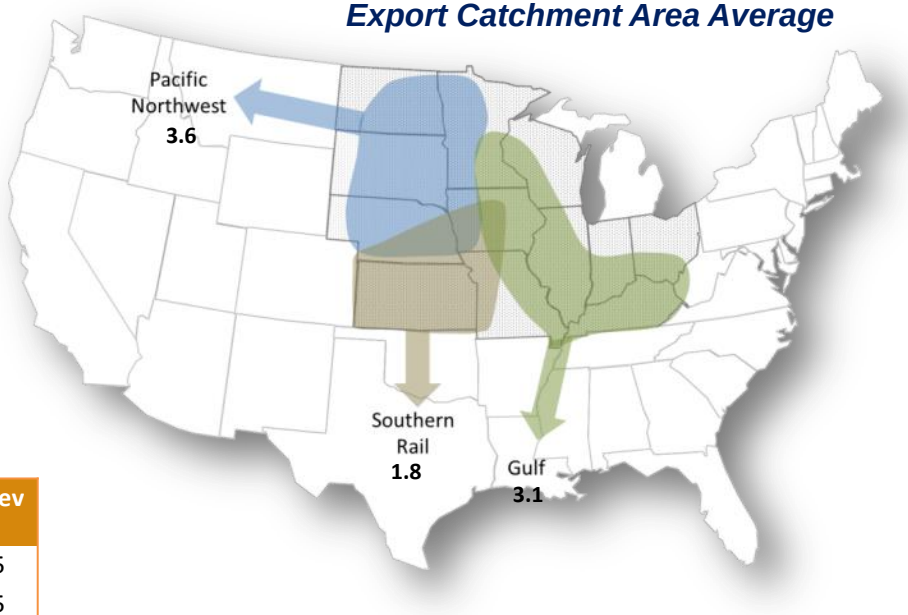
U.S. Aggregate: 3.0%

- Over 45% of the samples had ≤ 3% BCFM
- Slightly higher than 3YA (2.9%)



U.S. Aggregate	Avg (%)	Std Dev (%)
2014	3.0	0.65
2013	2.9	0.65
2012	2.7	0.68

BCFM (%)
Export Catchment Area Average



- Significantly lower in Southern Rail than in other two ECAs (also lower at harvest)

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Total Damage (%)

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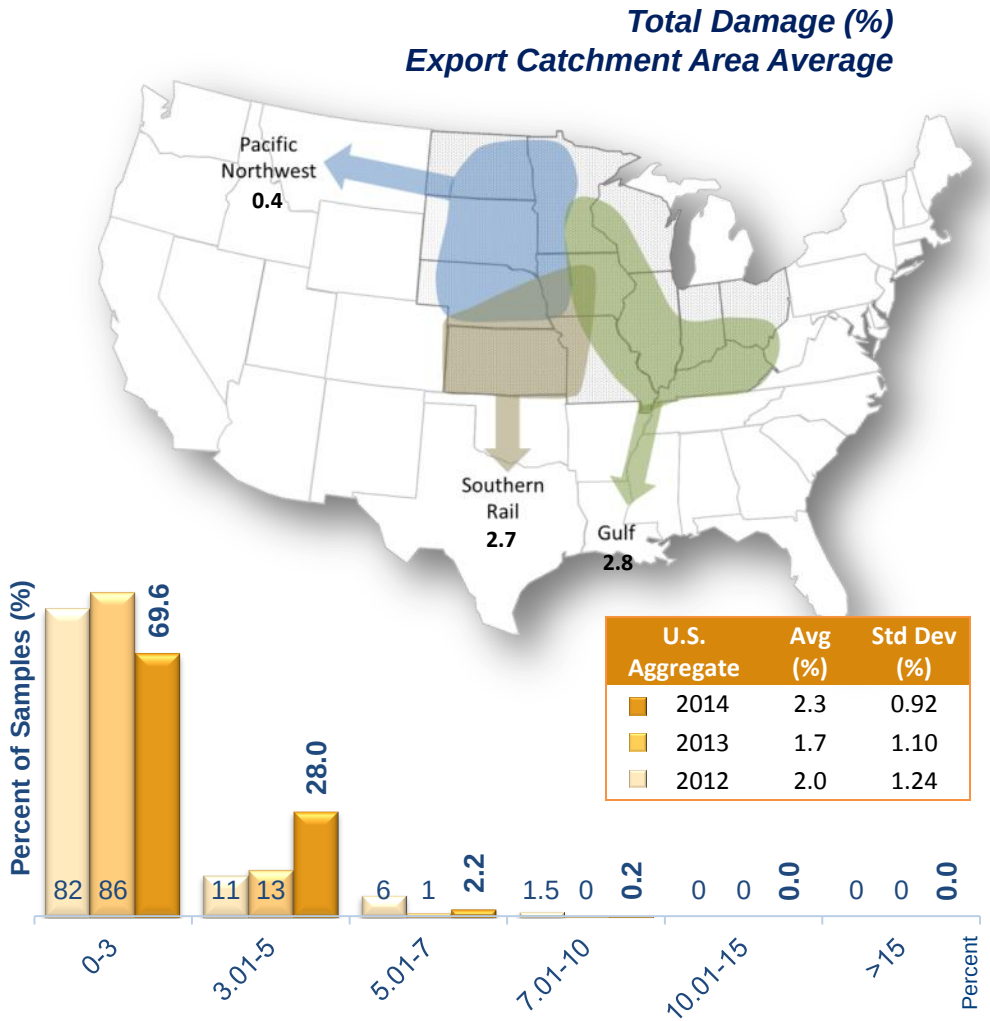
U.S. Aggregate: 2.3%

- 97.6% of all samples meet standard for U.S. No. 2
- Higher than 3YA
- PNW has consistently had lower total damage of the three ECAs



U.S. Aggregate	Avg (%)	Std Dev (%)
2014	2.3	0.92
2013	1.7	1.10
2012	2.0	1.24

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Heat Damage (%)

Heat Damage

- Only two samples showed any heat damage
- Indicates good management of the crop during storage

Moisture (%)

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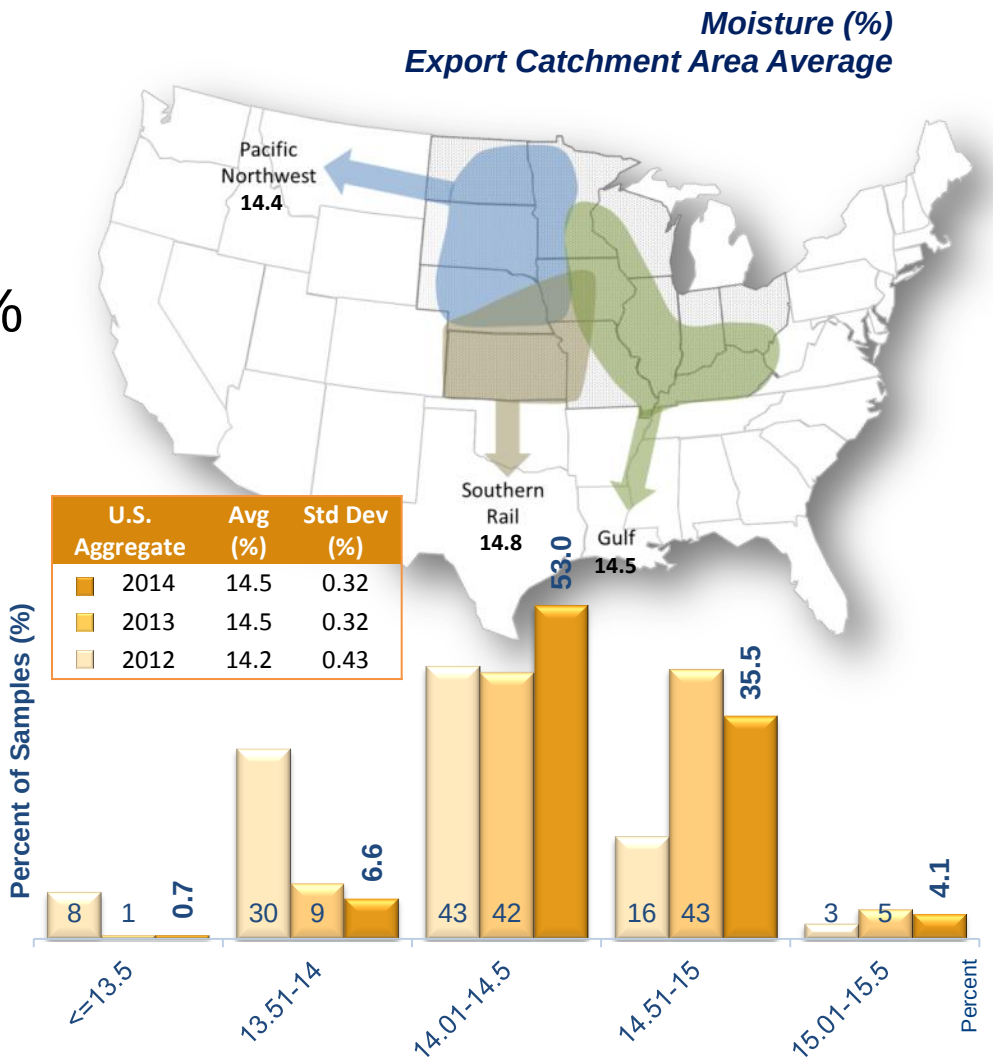
Not a grade factor

U.S. Aggregate: 14.5%

- Corn with moisture ≤ 14.5%
  - 2014/2015: 60.3%
  - 2013/2014: 52%
  - 2012/2013: 81%
- Higher than 3YA
- Highest ECA average in the Southern Rail ECA



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Chemical Composition

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Chemical Composition

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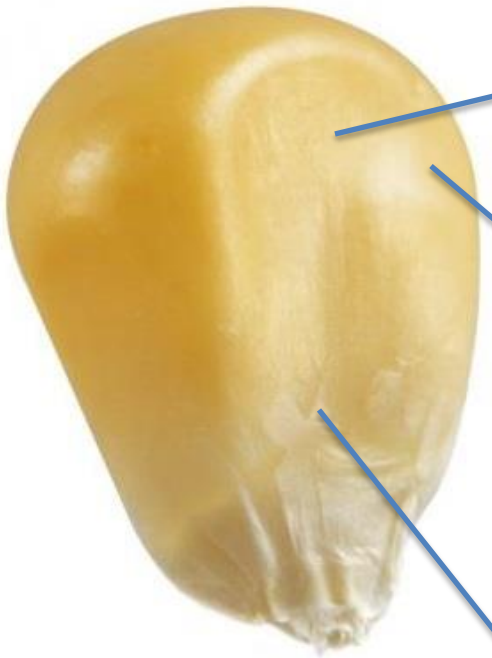

Protein
- Important for poultry and livestock feeding
- Supplies essential amino acids

Influenced by genetics, crop yields and available nitrogen during the growing season

Starch
- Important for wet millers and dry-grind ethanol manufacturers

Oil
- Important by-product of wet and dry milling
- Essential feed component

Influenced by genetics and crop yields

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Protein (Dry Basis %)

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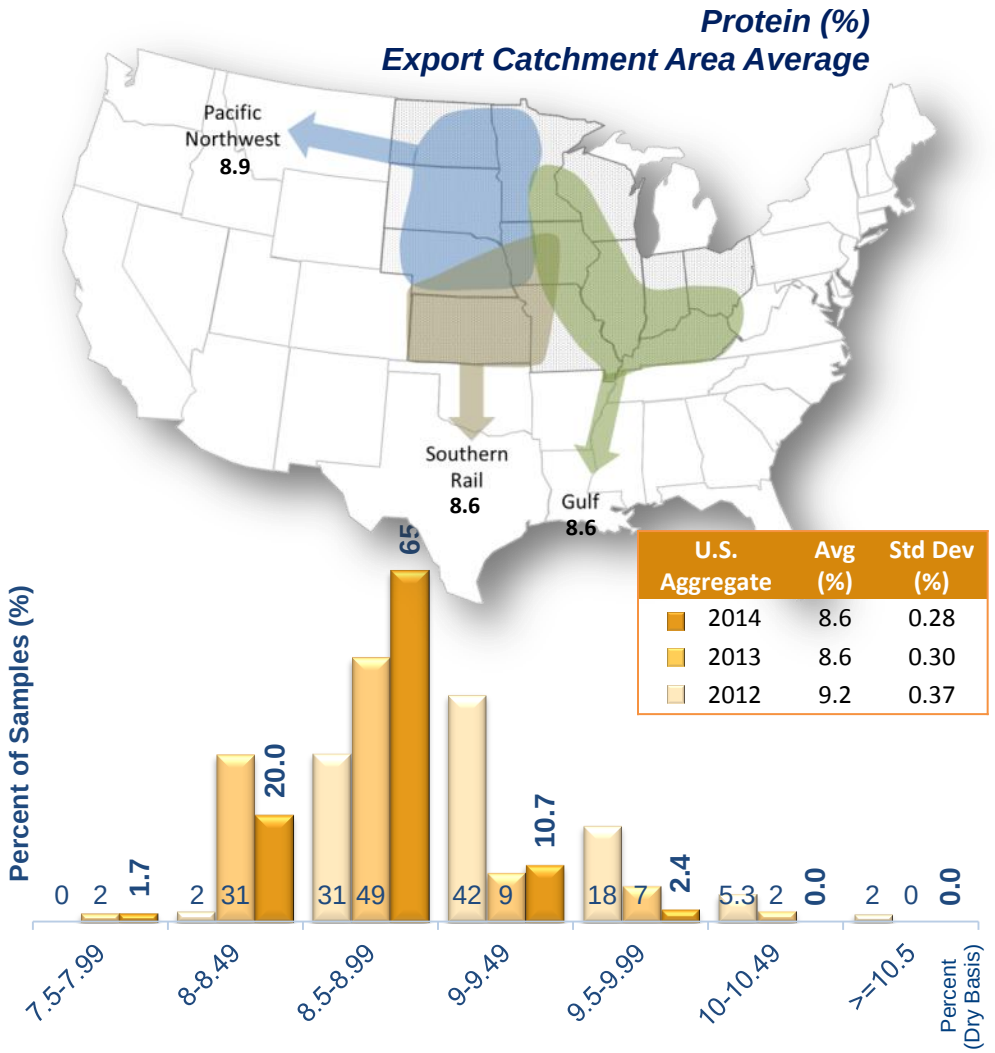
U.S. Aggregate: 8.6%

- Corn with protein concentration ≥ 9%
  - 2014/2015: 13.1%
  - 2013/2014: 18.2%
  - 2012/2013: 66.8%
- Lower than 3YA
- PNW has consistently had the highest concentration of the 3 ECAs



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Starch (Dry Basis %)

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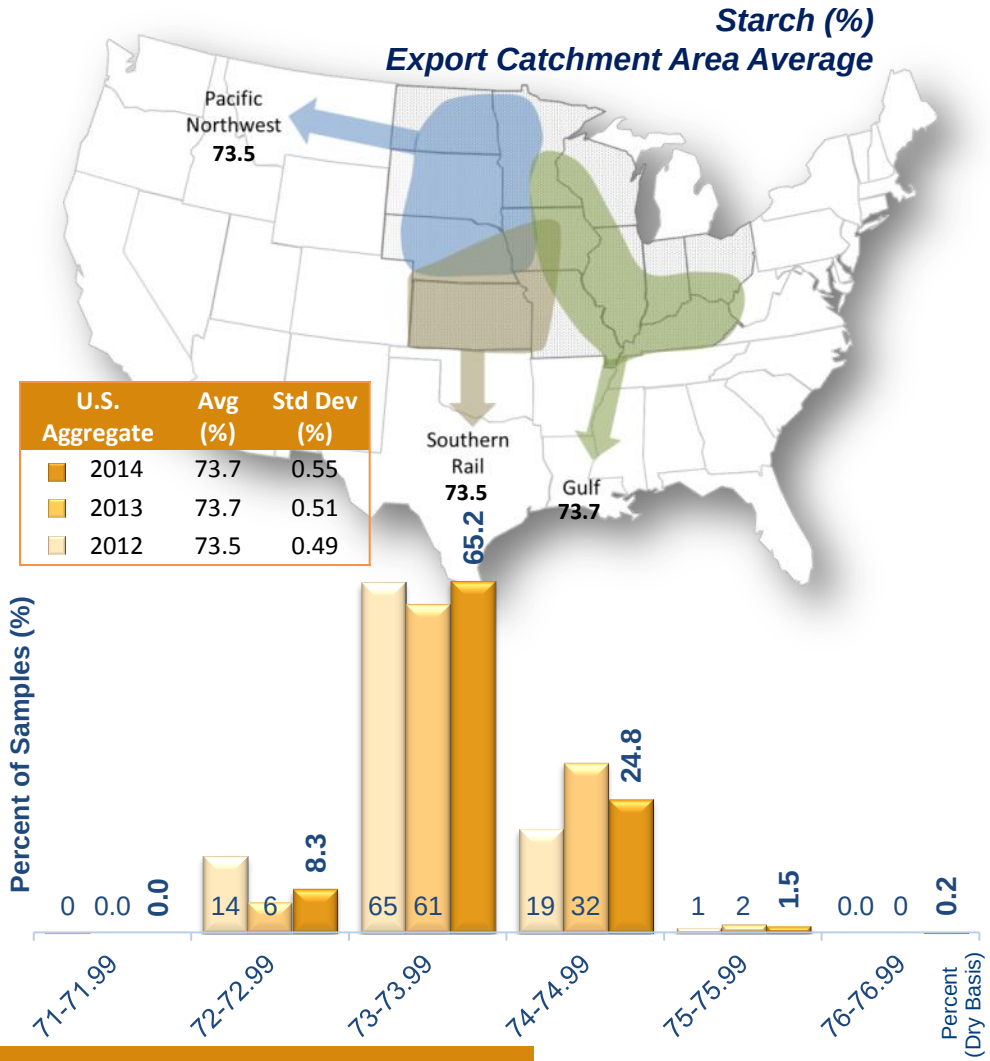
U.S. Aggregate: 73.7%

- Corn with starch concentration ≥ 74%
  - 2014/2015: 26.5%
  - 2013/2014: 34%
  - 2012/2013: 20%
- Lower than 3YA
- Gulf ECA had the highest concentration in 2014/2015 and 3YA



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Oil (Dry Basis %)

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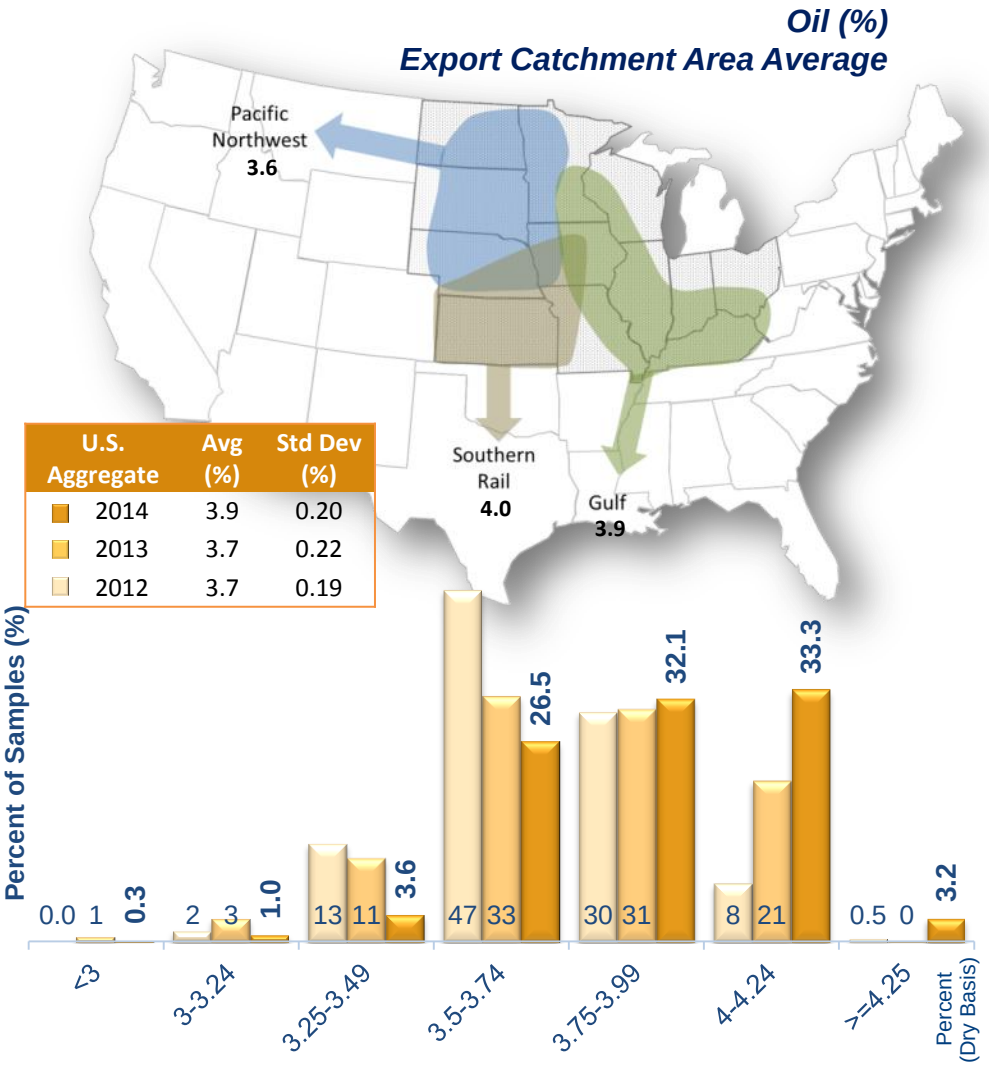
U.S. Aggregate: 3.9%

- Corn with oil concentration ≥ 3.75%
  - 2014/2015: 69%
  - 2013/2014: 52%
  - 2012/2013: 38.5%
- Higher than 3YA
- Southern Rail had the highest average concentration of the 3 ECAs for 2014/2015 and 3YA



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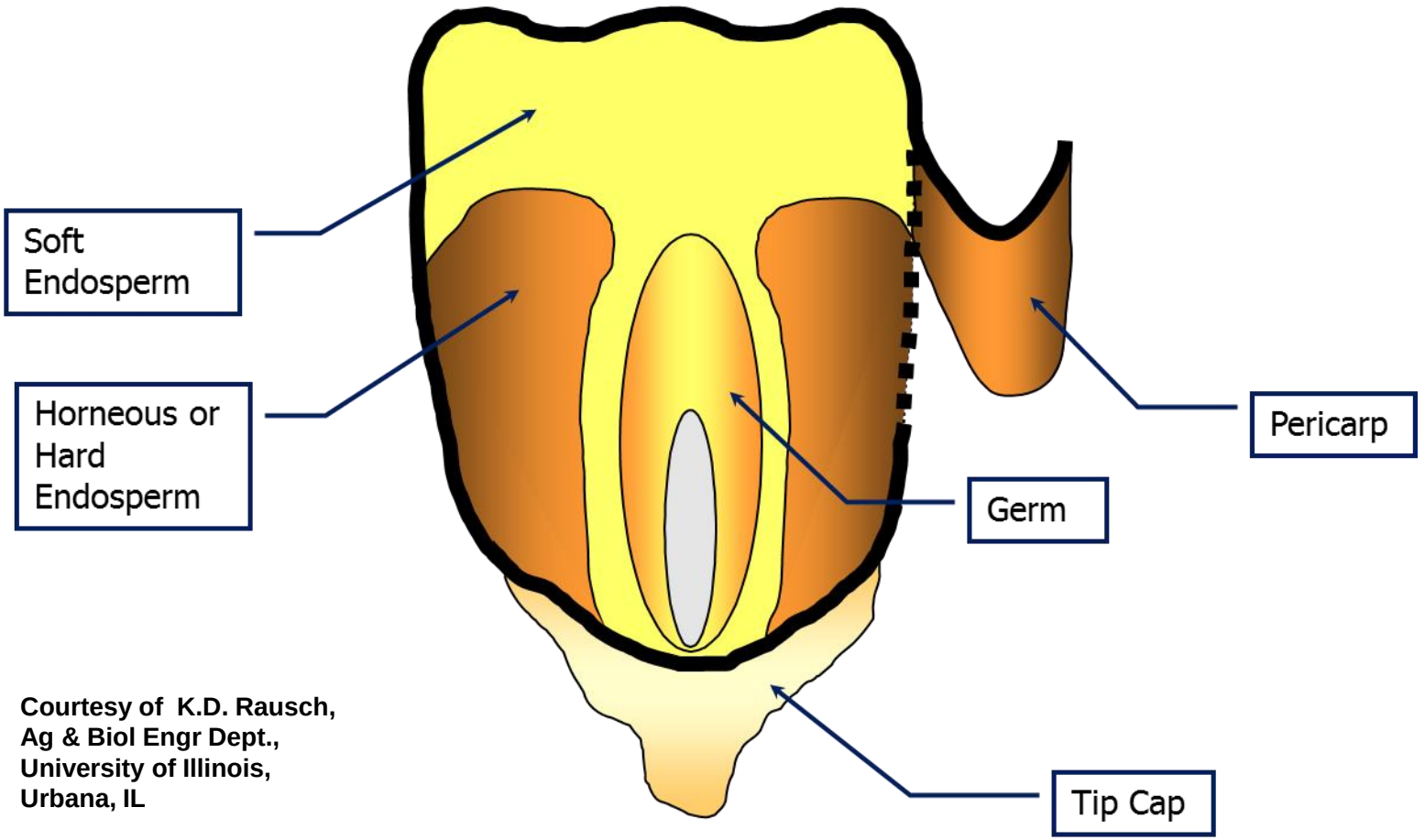

Courtesy of K.D. Rausch, Ag & Biol Engr Dept., University of Illinois, Urbana, IL

Physical Factors – Overview

Related to processing characteristics, storability and potential for breakage

- Stress cracks
- Stress cracks index
- Kernel weight, volume and density
- Whole kernels
- Horneous (hard) endosperm

Stress Cracks

- **Stress cracks**
  - Internal cracks in the horneous (hard) endosperm
  - Most common cause is artificial drying
  - Impacts breakage susceptibility, milling and alkaline cooking
- **Stress Crack Index (SCI)**
  - Measurement of single, double and multiple stress cracks
  - Range 0 – 500 (50 kernel sample)

Stress Crack Index (SCI)

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% kernels with 1 stress crack

X 1

+

% kernels with 2 stress cracks

X 3

+

% kernels with >2 stress cracks

X 5

= SCI

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Magnitude of SCI

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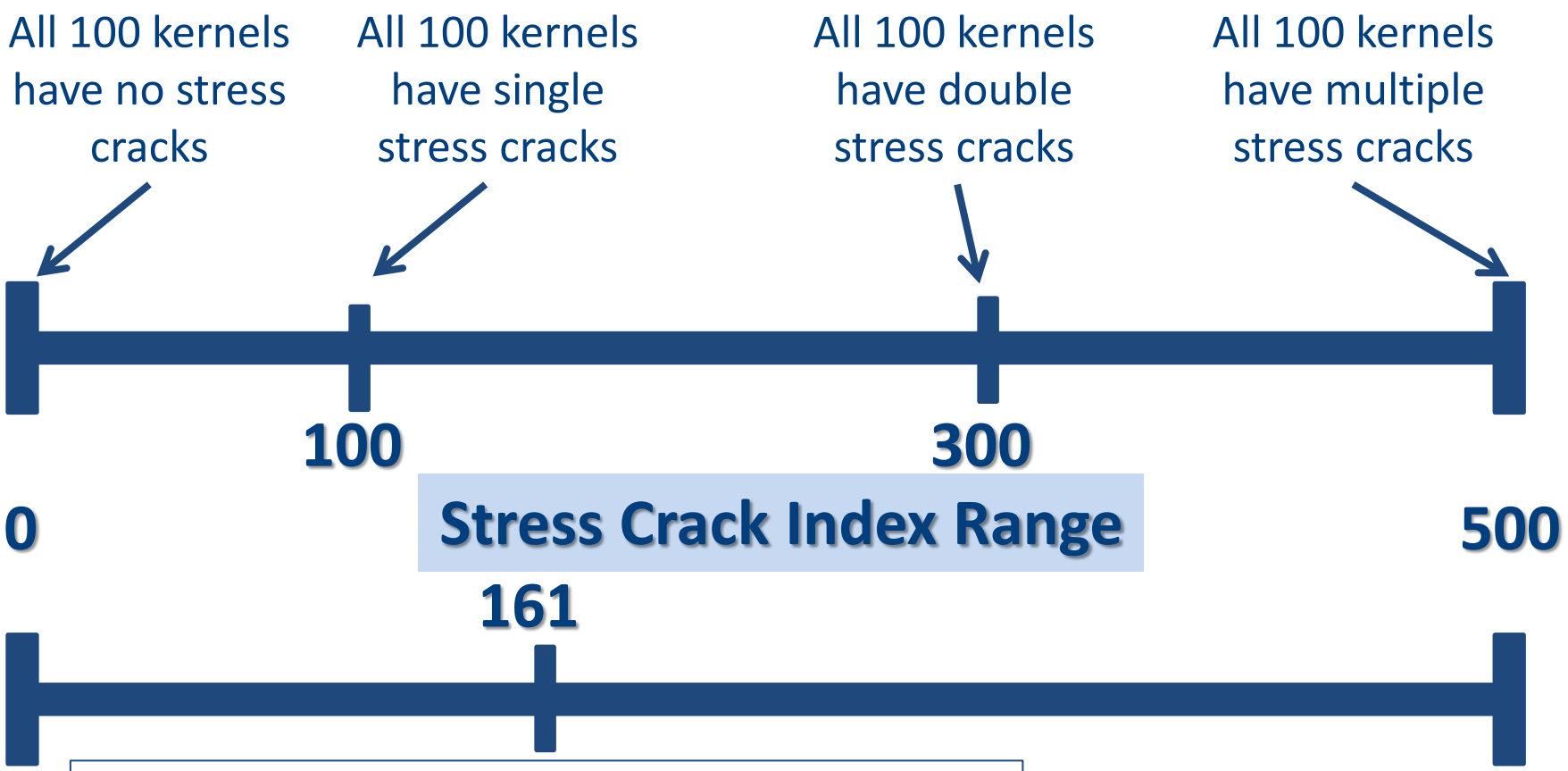

Example **SC% = 43%**

SCI Calculation:

(4%[a] x 1) + (19%[b] x 3) + (20%[c] x 5) = **161**

a: 4 kernels
b: 19 kernels
c: 20 kernels

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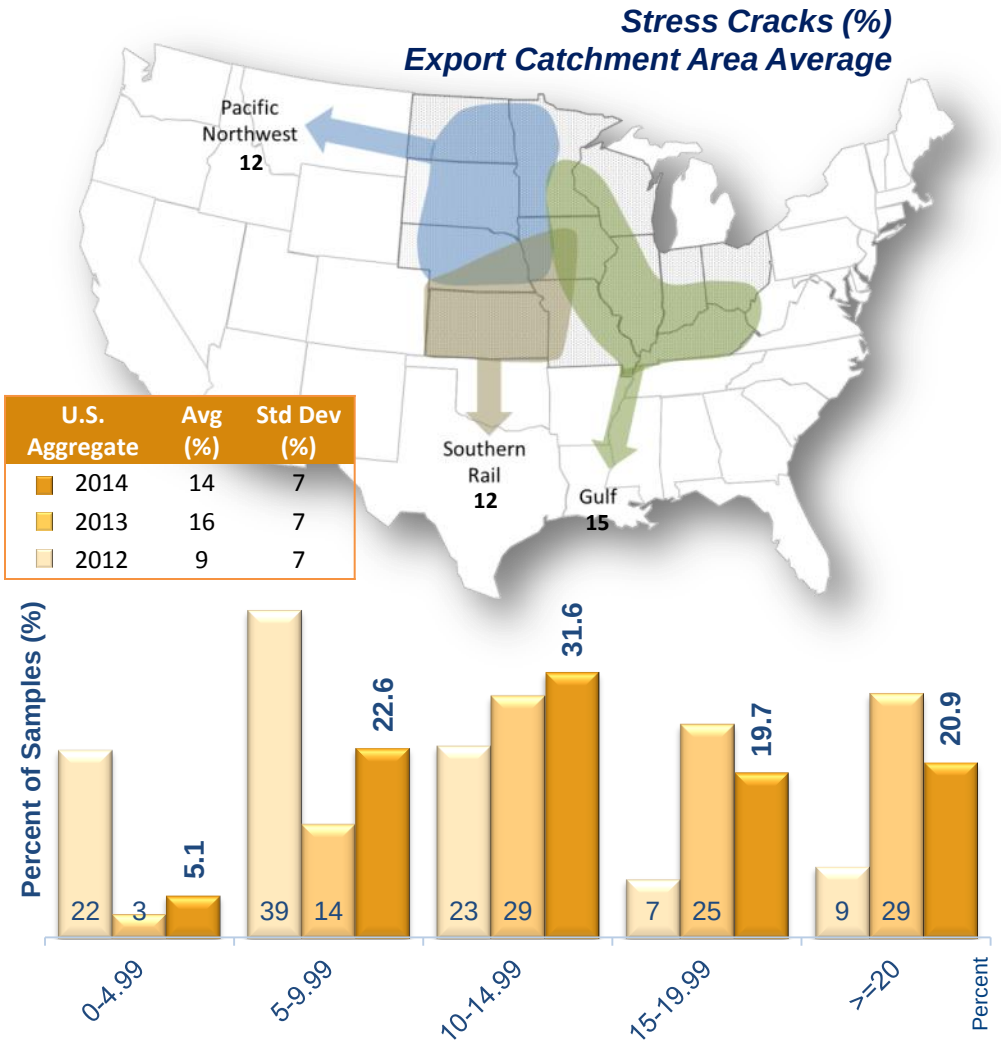
Stress Cracks (%)

U.S. Aggregate: 14%

- Corn with < 20% stress cracks
  - 2014/2015: 79.1%
  - 2013/2014: 71%
  - 2012/2013: 91%
- Slightly higher than 3YA
- Southern Rail had the lowest 3YA of the 3 ECAs



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Stress Cracks Index (SCI)

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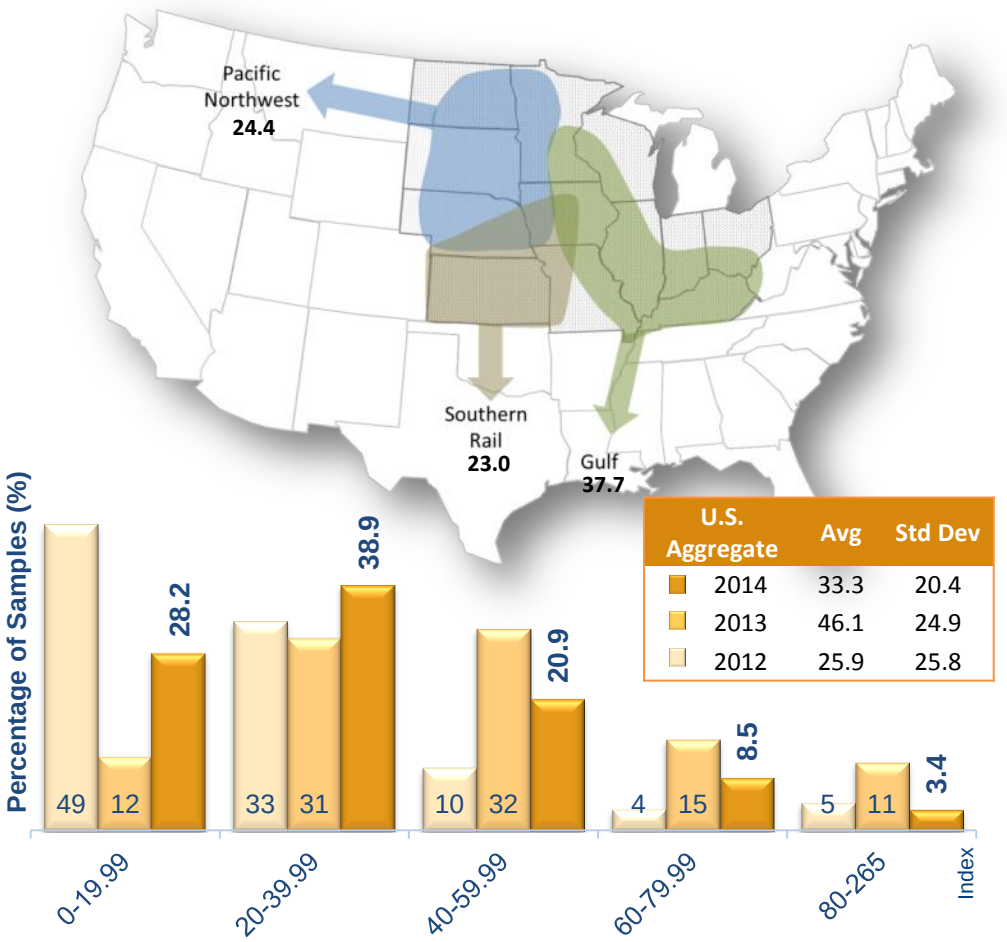
U.S. Aggregate: 33.3

- Corn with < 40 SCI
  - 2014/2015: 67.1%
  - 2013/2014: 43%
  - 2012/2013: 82%
- Slightly lower than 3YA
- Southern Rail had the lowest 3YA, along with 2014/2015 average of the 3 ECAs

Stress Cracks Index (%)
Export Catchment Area Average



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Kernel Weight, Volume, Density

Corn Export Cargo Quality Report 2014/2015

- Measure the size and composition of corn kernels
- Kernel volume is indicative of growing conditions and genetics

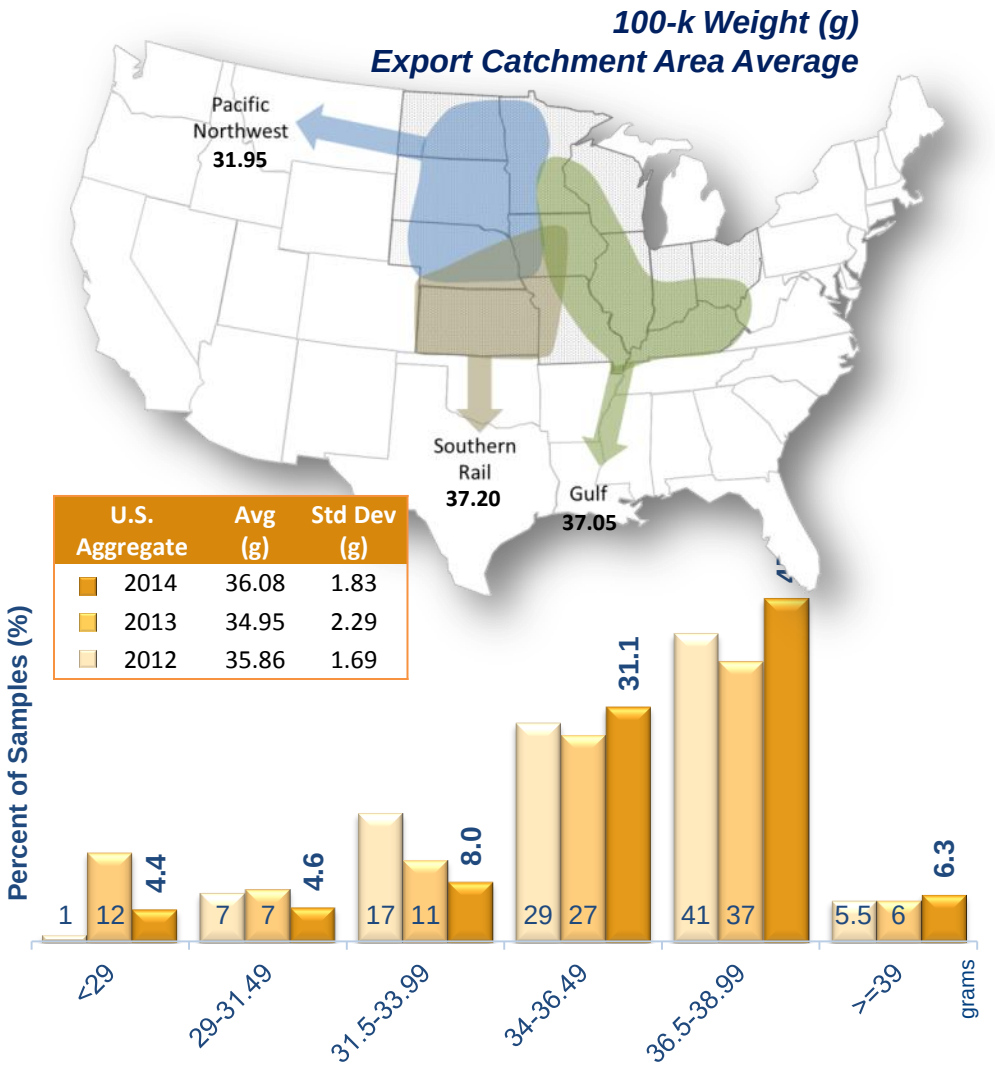
$$\frac{\text{100-Kernel Weight (mass) (g)}}{\text{Kernel Volume (cm}^3\text{)}} = \text{True Density (g/cm}^3\text{)}$$

- True density reflects kernel hardness
- Higher density – harder kernels; less susceptible to breakage; more desirable for dry milling and alkaline processing
- Lower density – softer kernels; less at risk for development of stress cracks if high temperature drying is employed; good for wet milling and feed use

100-kernel (100-k) Weight (grams)

U.S. Aggregate: 36.08 g

- Corn with 100-k weight ≥ 34.0 g
  - 2014/2015: 82.9%
  - 2013/2014: 70%
  - 2012/2013: 75.5%
- Higher than 3YA
- PNW had lowest 100-K weight of the 3 ECAs for 2014/2015 and 3YA



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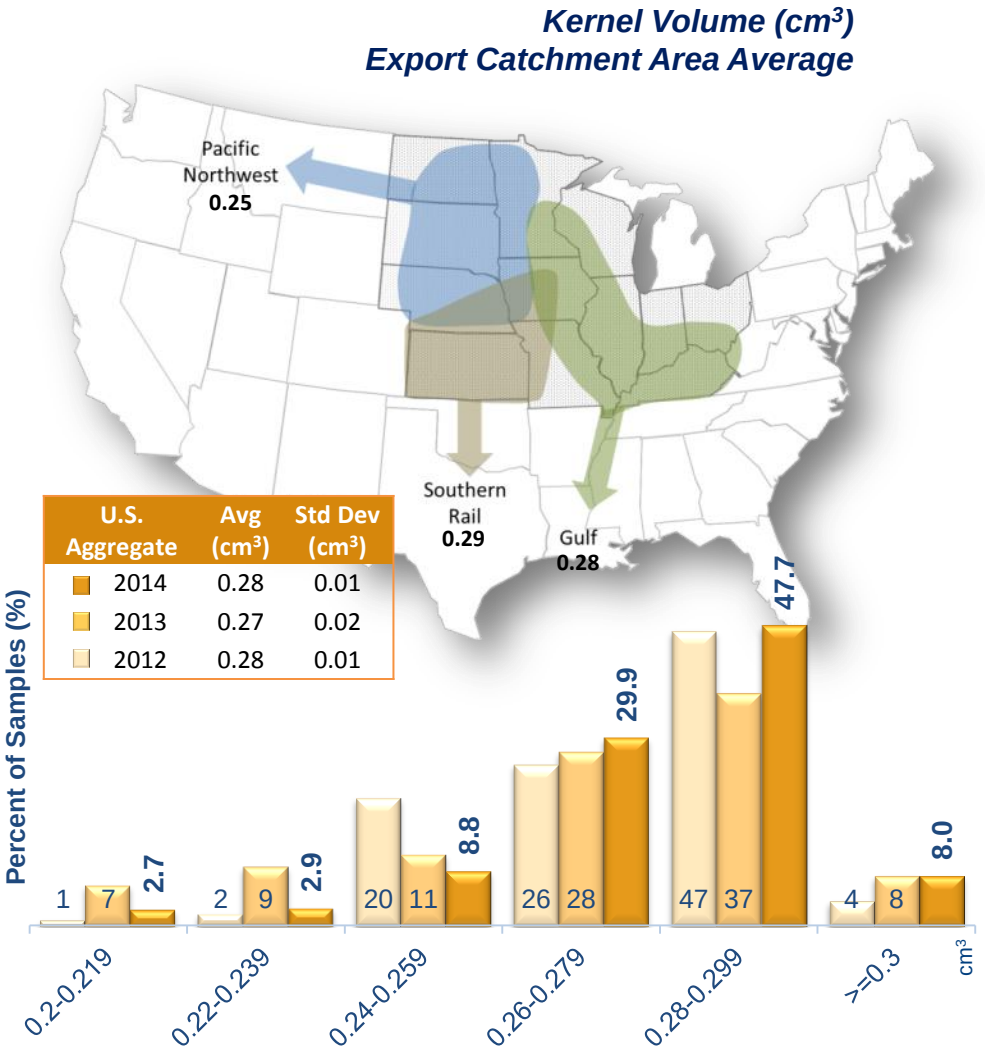
Kernel Volume (cm^3)

U.S. Aggregate: 0.28 cm^3

- Corn with kernel volume ≥ 0.26 cm^3
  - 2014/2015: 85.6%
  - 2013/2014: 73%
  - 2012/2013: 77%
- Higher than 3YA
- PNW had lowest kernel volume of the 3 ECAs for 2014/2015 and 3YA



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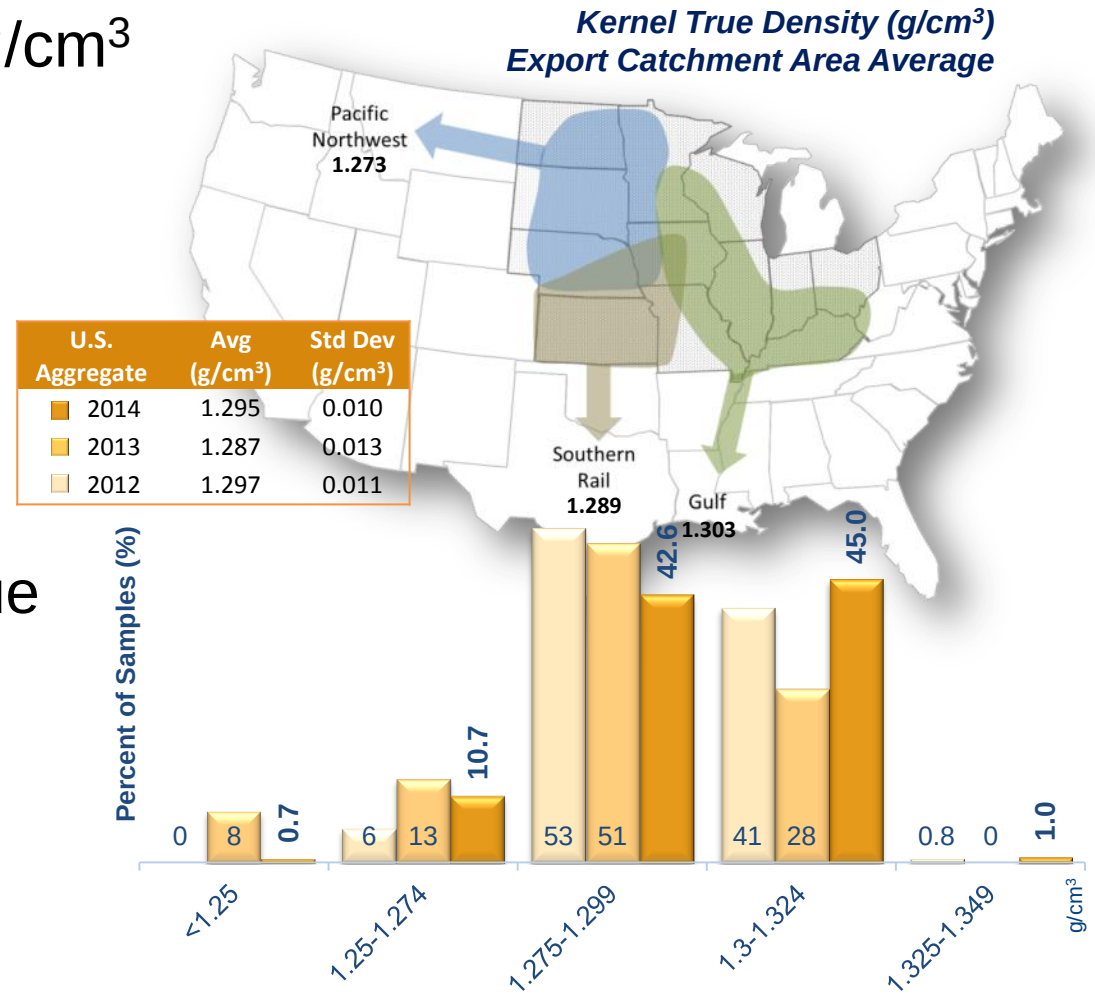
Kernel True Density (g/cm³)

U.S. Aggregate: 1.295 g/cm³

- Corn with true density ≥ 1.275 g/cm³
  - 2014/2015: 88.6%
  - 2013/2014: 79%
  - 2012/2013: 94.8%
- Higher than 3YA
- Gulf had the highest true density of the 3 ECAs for 2014/2015 and 3YA



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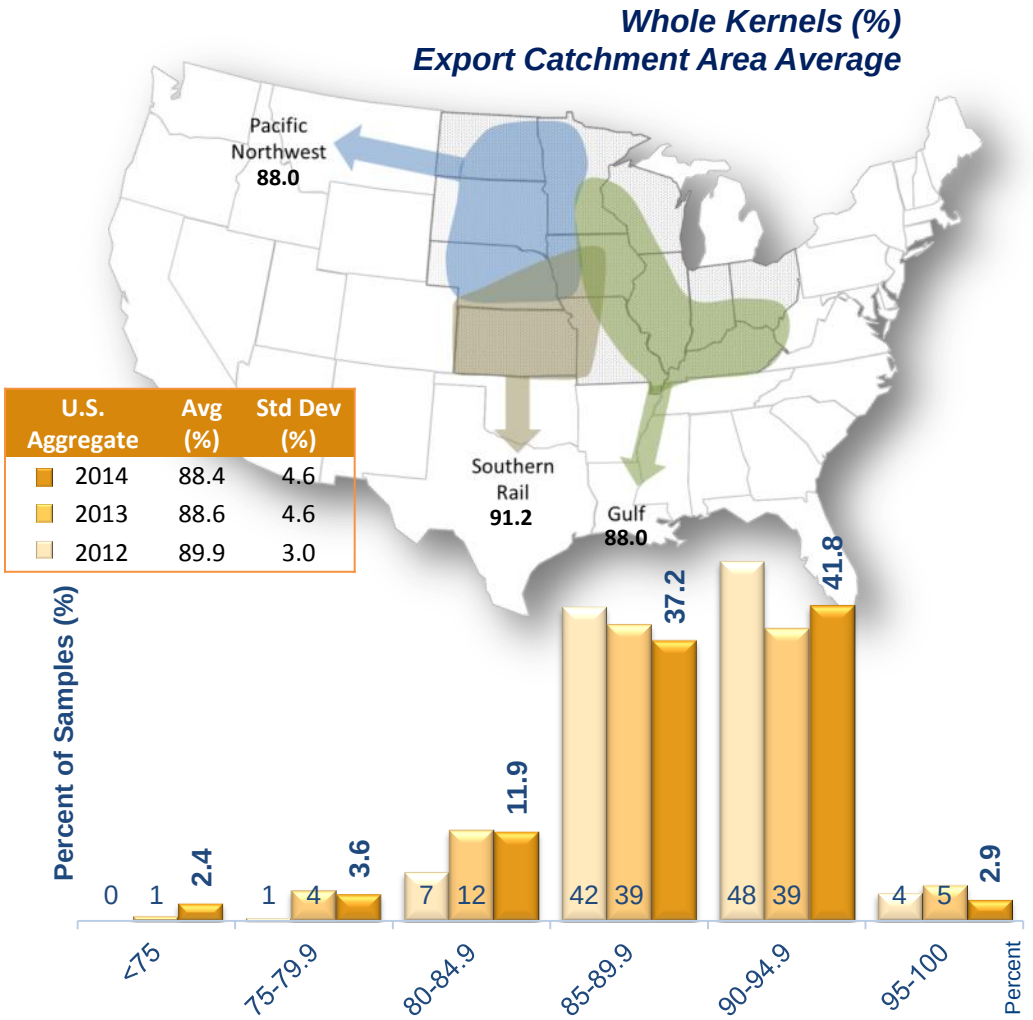
Other Physical Properties

- **Whole kernels**
  - Percentage of whole kernels of a 50 g sample
  - 'Broken Corn' in BCFM measures only kernel size, not whether it is broken or whole
  - Impacts alkaline cooking operations and susceptibility to mold invasion and breakage
- **Horneous (hard) endosperm**
  - Measures the percent of the endosperm that is *horneous* or hard within a range from 70 – 100%
  - The higher the value, the harder the corn kernel

Whole Kernels (%)

U.S. Aggregate: 88.4%

- Corn with whole kernels ≥ 90%
  - 2014/2015: 44.7%
  - 2013/2014: 43.7%
  - 2012/2013: 52%
- Lower than 3YA
- While Southern Rail had the highest percentage in 2014/2015, PNW had the highest percentage of 3YA



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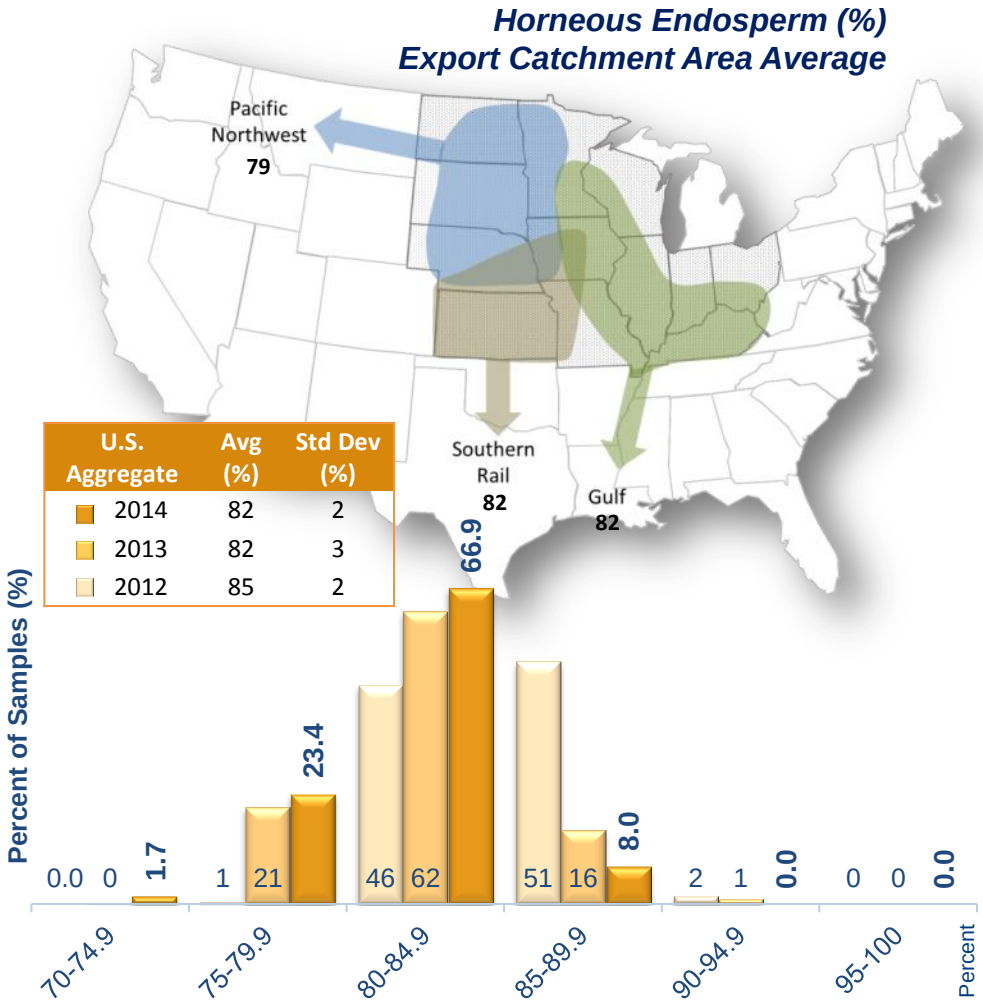
Horneous (Hard) Endosperm (%)

Corn Export Cargo Quality Report 2014/2015

U.S. Aggregate: 82%

- Corn with horneous endosperm ≥ 80%
  - 2014/2015: 74.9%
  - 2013/2014: 79.1%
  - 2012/2013: 98%
- Lower than 3YA
- Gulf and Southern Rail have had similarly high horneous endosperm percentages



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Mycotoxins: Aflatoxins and DON

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Mycotoxin Testing

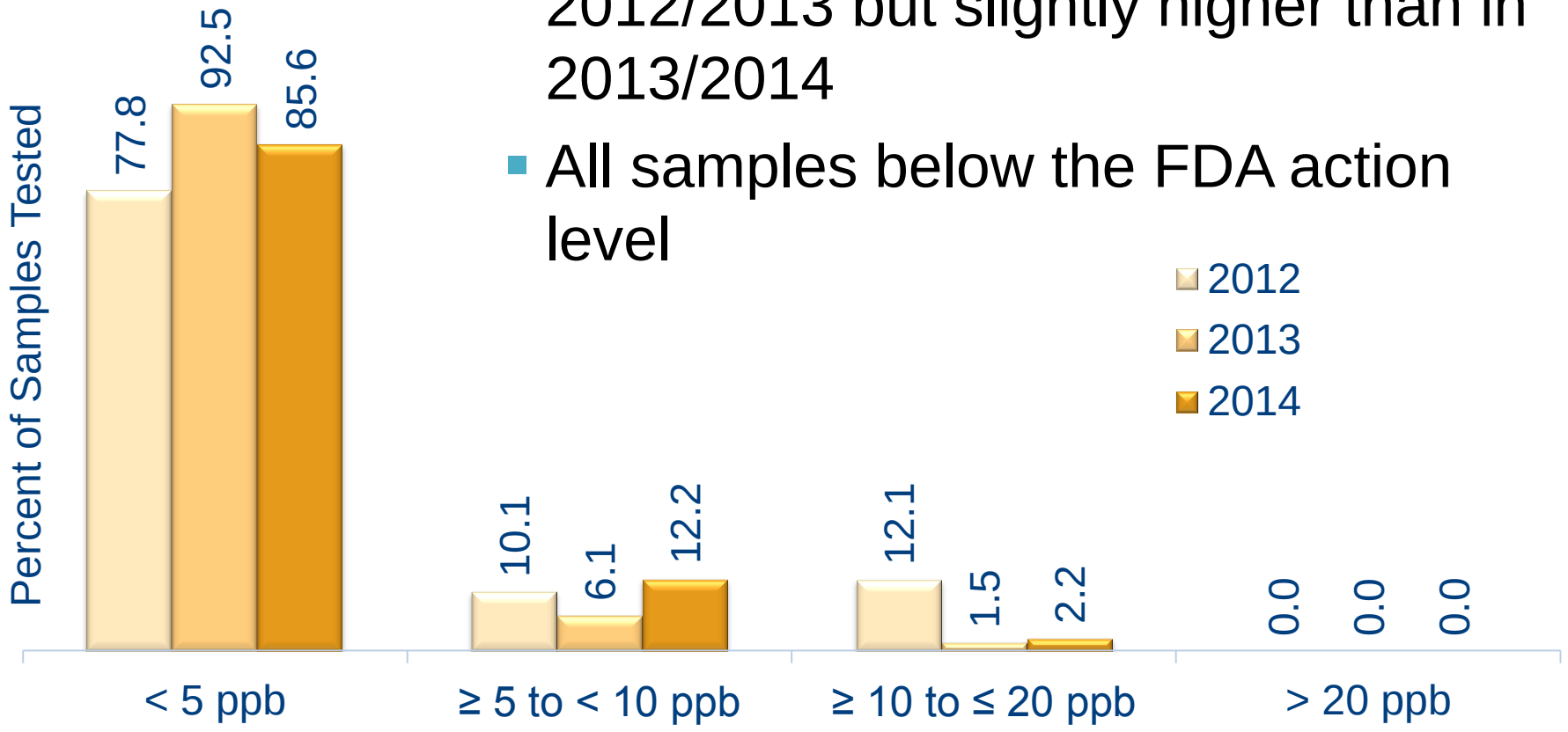
- Provides an assessment of the presence of aflatoxins and DON in U.S. corn as it reaches export points early in the marketing year

- Reports ONLY the frequency of detected elevated levels of the mycotoxins in export samples

Aflatoxins Testing Results

Corn Export Cargo Quality Report 2014/2015

- Fewer incidents (<10 ppb) than in 2012/2013 but slightly higher than in 2013/2014
- All samples below the FDA action level



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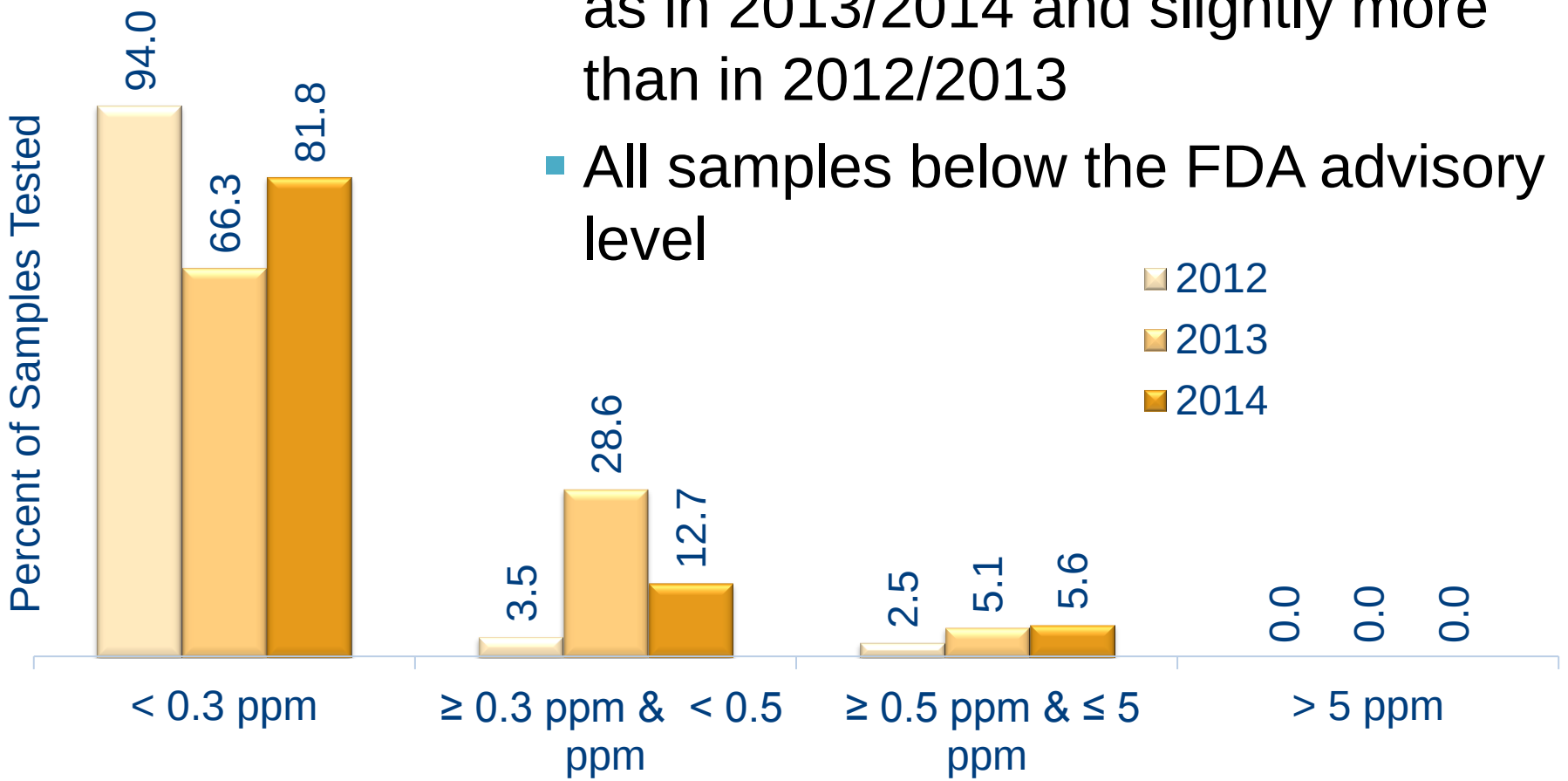
DON Testing Results

Corn Export Cargo Quality Report 2014/2015

- About the same incidents (<0.5 ppm) as in 2013/2014 and slightly more than in 2012/2013
- All samples below the FDA advisory level



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Summary & Conclusions

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Export Cargo Report: Conclusions

Corn Export Cargo Quality Report 2014/2015

- Early 2014/2015 U.S. corn exports were, on average, better than or equal to U.S. No. 2 on all grade factors
- Mycotoxin results suggest, on average, low levels of aflatoxins and DON in export shipments
- Similar protein and starch but higher oil concentrations than in 2013/2014
- Lower stress cracks, larger kernels, and higher true density than in 2013/2014

Corn Quality Reports: Looking Ahead

Corn Export Cargo Quality Report 2014/2015

- Hoping for a high quality corn crop in 2015
- Fifth year of *Harvest and Export Cargo Reports* will be released in December 2015 and April 2016 respectively.
- Each year of these reports increases their value:
  - Several years of results using the same survey and testing methodology can be compared
  - Patterns in quality and factors that influence quality are surfacing

Other Components of the Corn Export Cargo Quality Report

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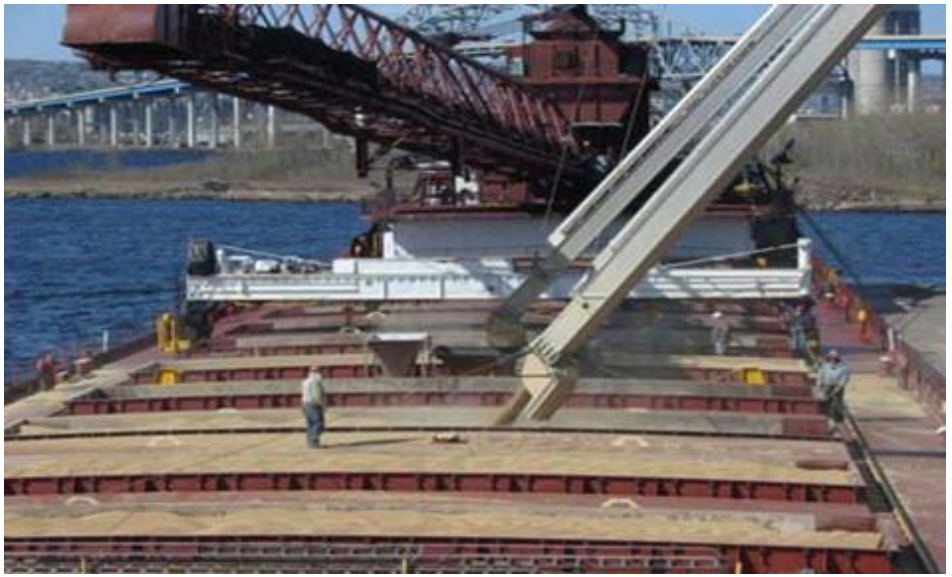
Other Features of the Report

- U.S. Corn Export System
- Survey and Statistical Analysis Methods
- Testing Analysis Methods



Building a Tradition: Thank You!

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Developing markets. >> Enabling trade. >> Improving lives.