U.S. Grains Council 2015/2016 Sorghum Export Cargo Quality

[Insert Date]
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Developing markets. >> Enabling trade. >> Improving lives.

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Mission

- Developing markets, enabling trade, improving lives

Reports

- Help buyers make better informed decisions
- Increase confidence in the capacity and reliability of the market
- Assist nations around the world in achieving food security through trade

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Committed to global food security and mutual economic benefit through trade

- Excellence in Exports
- Growing the value of trade
- Promoting food security and economic growth
- Adding valuable expertise
- Nurturing reliable trade policies

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Sorghum Quality Reports

Motivation

- Lack of information on quality of U.S. sorghum
- Growth of U.S. sorghum exports
- Success of USGC Corn Quality Reports

Objective

- To provide information proactively on the U.S. sorghum crop to international buyers
  - Harvest
  - Early exports

Early Harvest Quality Report

Initial look at crop quality from early harvest areas

50 samples collected during August and September

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Harvest and Export Cargo Report

Harvest
U.S. Aggregate
Plus
Two Harvest Areas

Export Cargo
U.S. Aggregate
Plus
Two Export Outlets

Quality across key production areas

Export quality early in marketing year

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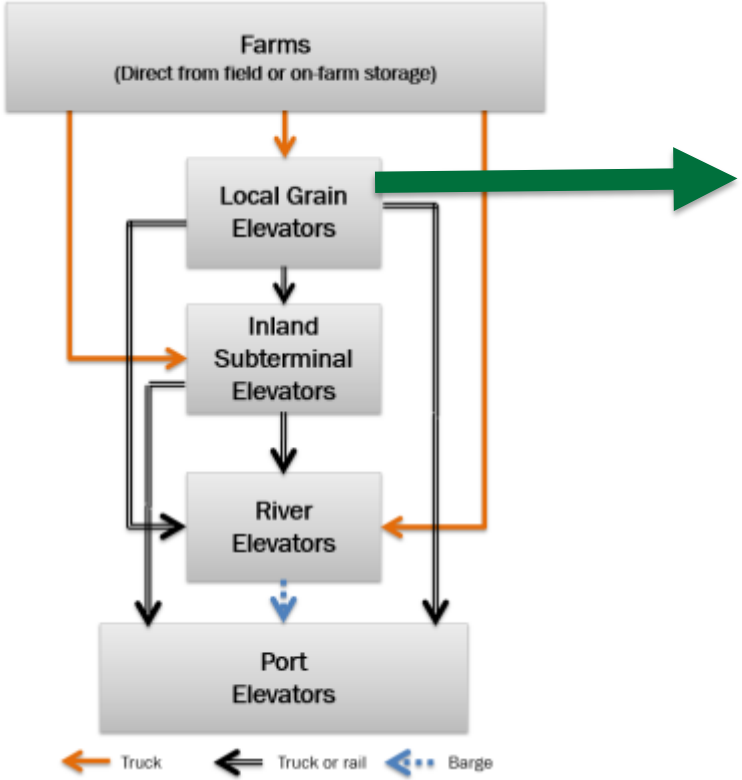
USGC Quality Sampling



Harvest Sampling

- Initial levels and variability of quality characteristics across the diverse geographic regions
- Inbound, unblended commodity samples from local elevators

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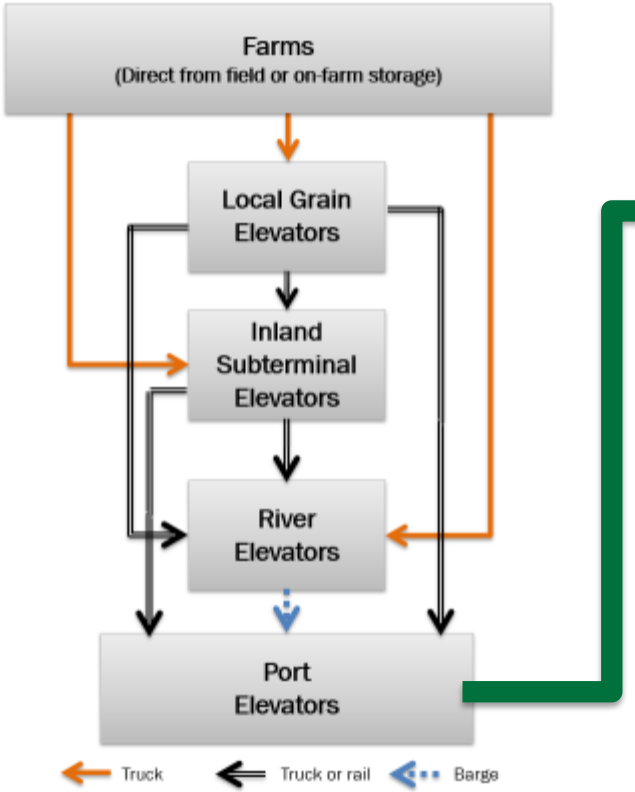
USGC Quality Sampling



Export Sampling

- Initial levels and variability of early export quality at ports
- Commodity sorghum samples collected by USDA at key export outlets

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Quality Factors Tested

Grading Factors
- Test weight
- Broken kernel/foreign material
  - Foreign material
- Total damage/Heat damage

Physical Factors
- Kernel diameter
- 1000-kernel weight
- Kernel volume
- True density
- Kernel hardness index

Moisture

Chemical Composition
- Protein
- Starch
- Oil
- Tannins

Mycotoxins
- Aflatoxins
- DON

Export Cargo 2015/2016 Highlights

Grade Factors

- Average for all factors exceeded criteria for U.S. No. 1 grade

Chemical Composition

- Typical protein, starch, and oil concentrations compared to previous research
- All samples were considered tannin-free

Moisture

- Moisture recorded at export points averaged 13.8%

Physical Factors

- On average, U.S. Export Aggregate had less volume than kernels from any sorghum crop
- Typical kernel diameter, hardness, weight and true density for any commercial sorghum hybrid sample

Export Cargo 2015/2016 Highlights

Aflatoxins

- 100% of the samples tested below the FDA action level

DON

- All samples tested below the FDA advisory level

Grade Factors and Moisture

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Grades and Grade Requirements

Grade	Min. Test Weight per Bushel (Pounds)	Maximum Limits of: Heat Damaged (%)	Total Damage (%)	Foreign Material (part of total) (%)	Broken Kernel and Foreign Material (%)
U.S. No. 1	57.0	0.2	2.0	1.0	3.0
U.S. No. 2	55.0	0.5	5.0	2.0	6.0
U.S. No. 3	53.0	1.0	10.0	3.0	8.0
U.S. No. 4	51.0	3.0	15.0	4.0	10.0

Source: USDA Federal Grain Inspection Service (FGIS)

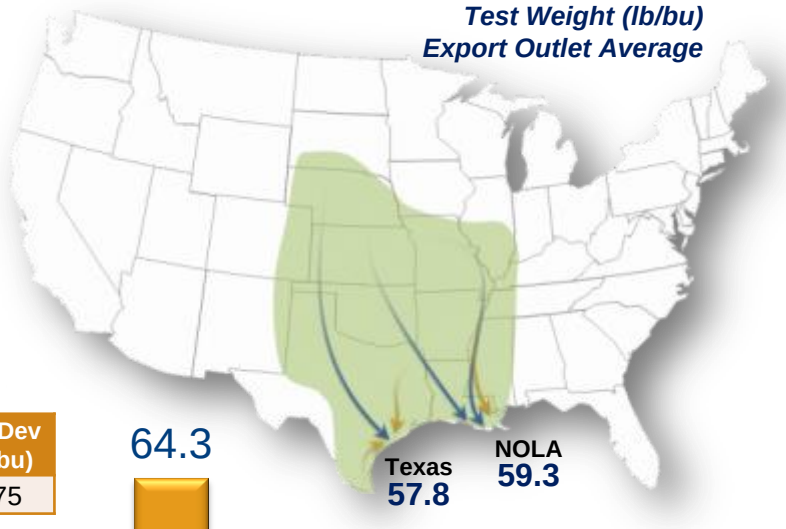
Grade Factors and Moisture

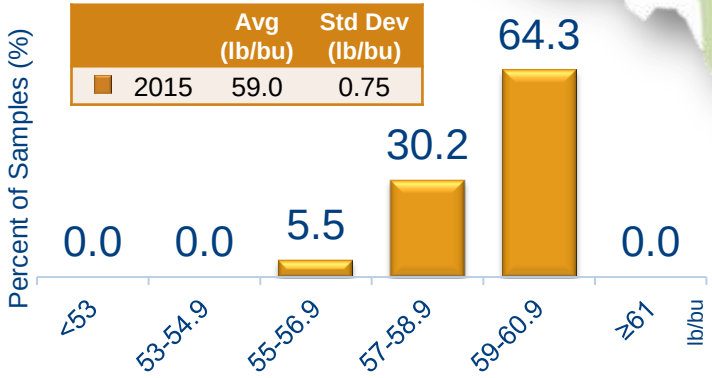
	No. of Samples	Avg.	Std. Dev.	Min.	Max.
Test Weight (lb/bu)	182	59.0	0.75	56.2	60.5
Test Weight (kg/hl)	182	76.0	0.97	72.3	77.9
BNFM (%)	182	1.9	0.52	1.0	4.6
Foreign Material (%)	182	0.9	0.39	0.1	3.4
Total Damage (%)	182	0.5	0.33	0.0	2.1
Heat Damage (%)	182	0.0	0.00	0.0	0.0
Moisture (%)	182	13.8	0.34	12.3	14.6

Test Weight – U.S. Units

U.S. Aggregate: 59.0 lb/bu

- Average above the minimum for U.S. No. 1 grade
- All the samples at or above the limit for U.S. No. 2 grade
- NOLA average higher than Texas average





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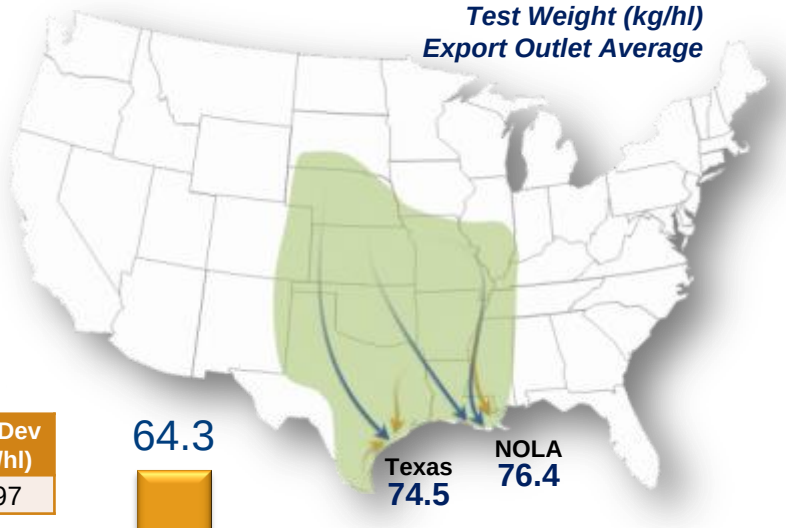
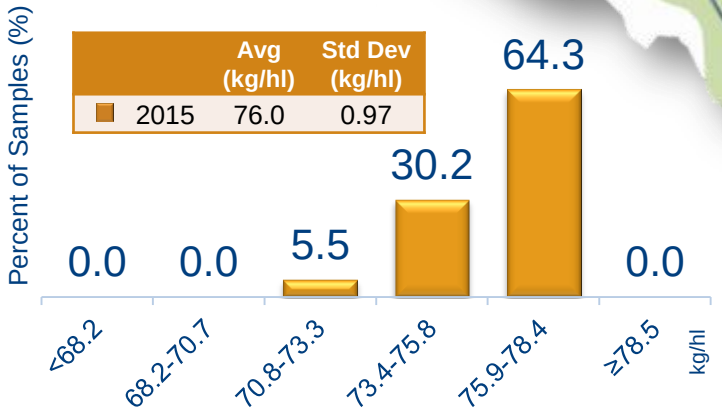
Test Weight - Metric

U.S. Aggregate: 76.0 kg/hl

- Average above the minimum for U.S. No. 1 grade
- All the samples at or above the limit for U.S. No. 2 grade
- NOLA average higher than Texas average





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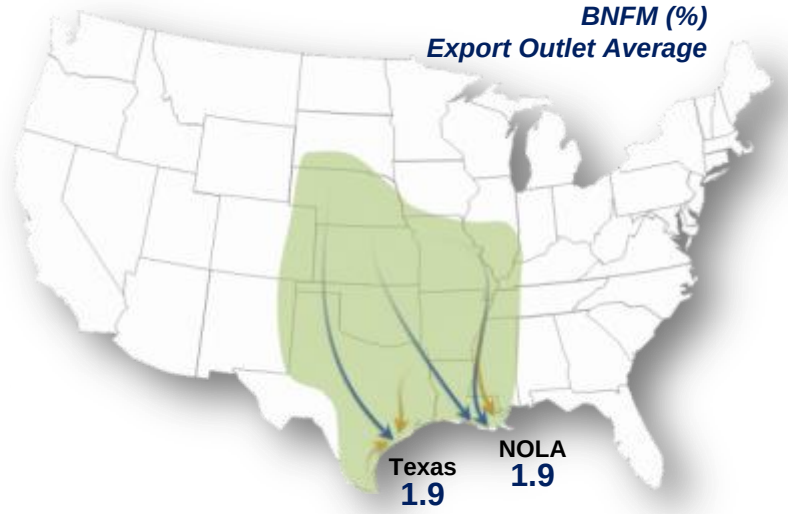
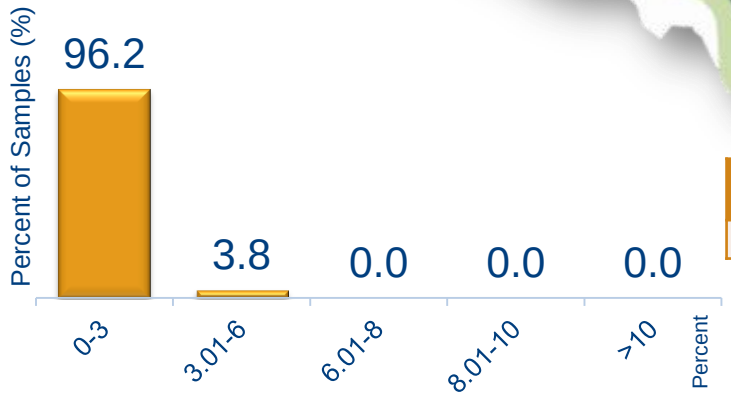
Broken Kernels and Foreign Material (BNFM) (%)

U.S. Aggregate: 1.9%

- Average well below the maximum for U.S. No. 1 grade
- All samples were below the maximum for U.S. No. 2 grade





	Avg (%)	Std Dev (%)
2015	1.9	0.52

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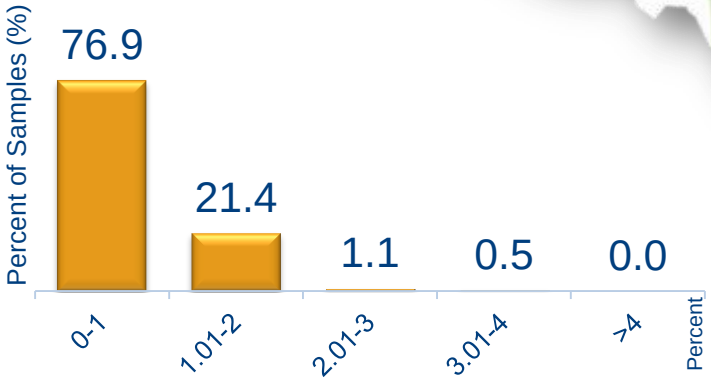
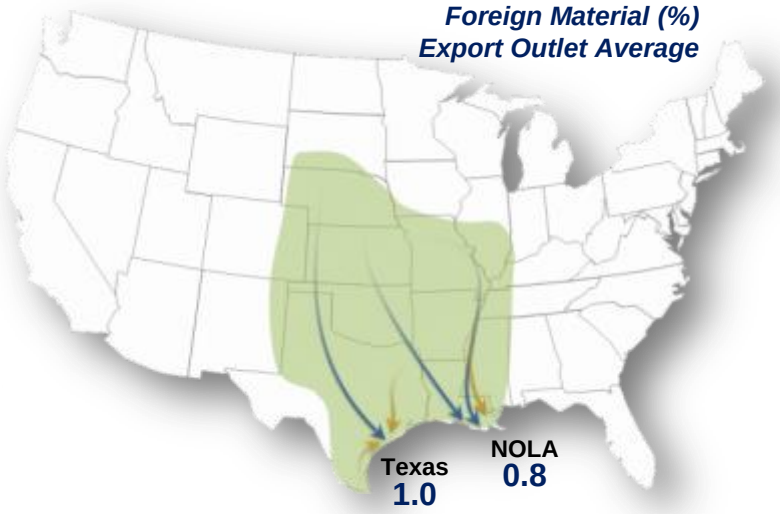
Foreign Material (%)

U.S. Aggregate: 0.9%

- Average below the maximum for U.S. No. 1 grade
- 98% were at or below the maximum allowable for U.S. No. 2 grade
- NOLA average lower than Texas average





	Avg (%)	Std Dev (%)
2015	0.9	0.39

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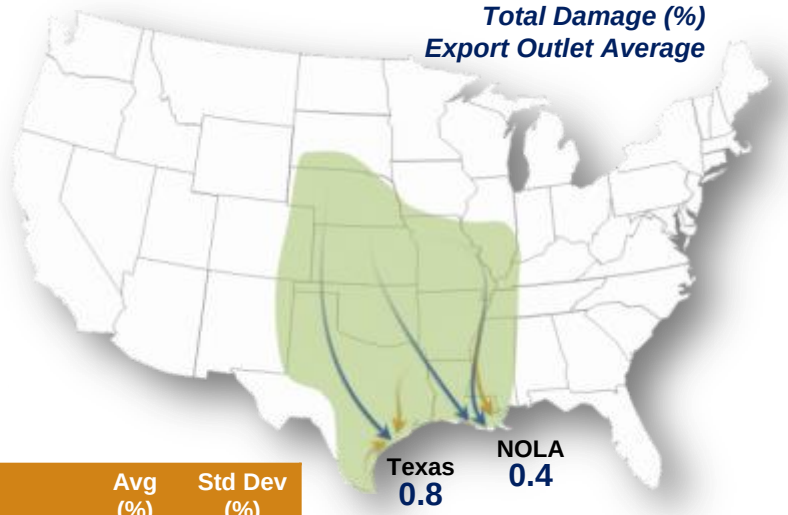
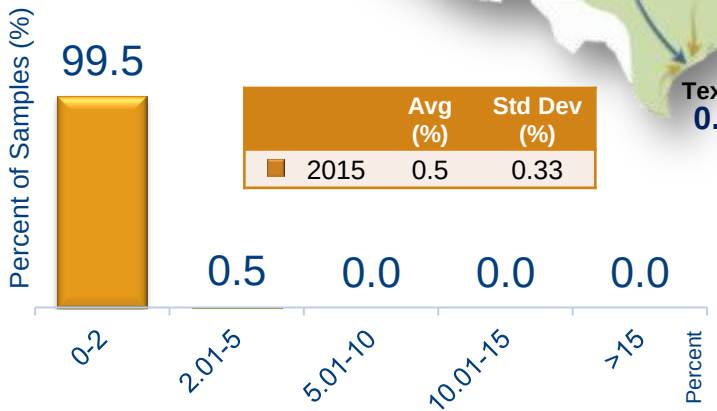
Total Damage (%)

U.S. Aggregate
Total Damage: 0.5%

- Average well below the maximum for U.S. No. 1 grade
- 100% were at or below the maximum allowable for U.S. No. 2 grade
- NOLA average lower than Texas average





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Heat Damage (%)

Heat Damage: Zero

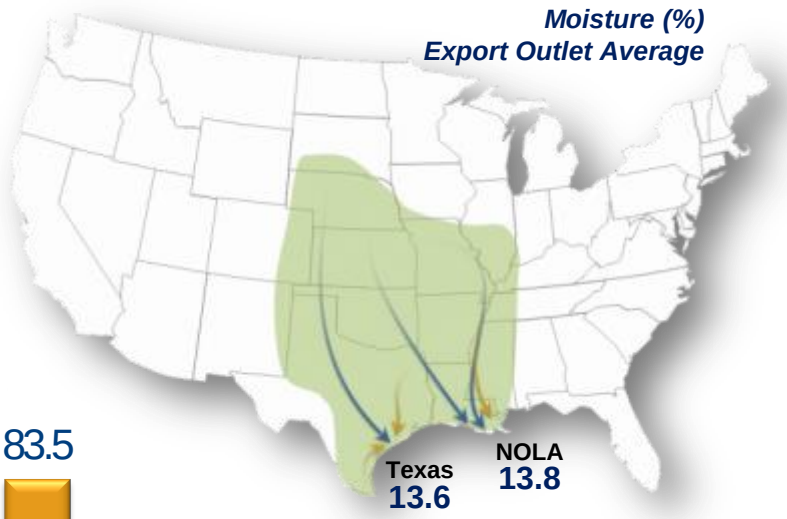
- None observed at export
- The absence of heat damage likely was due in part to harvested samples moving quickly from farm to export loadout facility with minimal or no prior drying

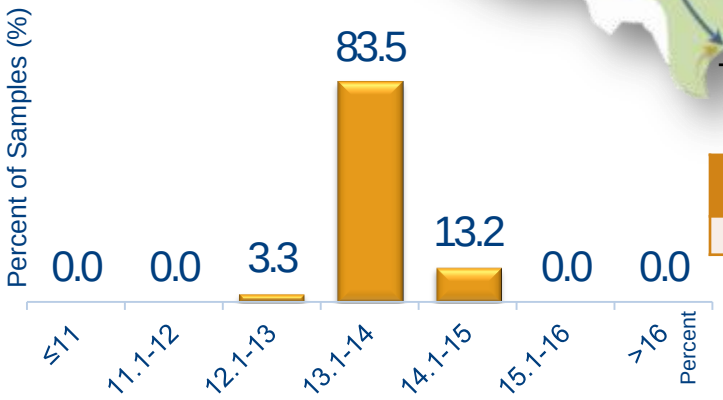
Moisture (%)

Not a grade factor

U.S. Aggregate: 13.8%

- Lower and less variable than harvest samples
- 87% contained 14% or less moisture
- Texas average slightly lower than NOLA





	Avg (%)	Std Dev (%)
2015	13.8	0.34

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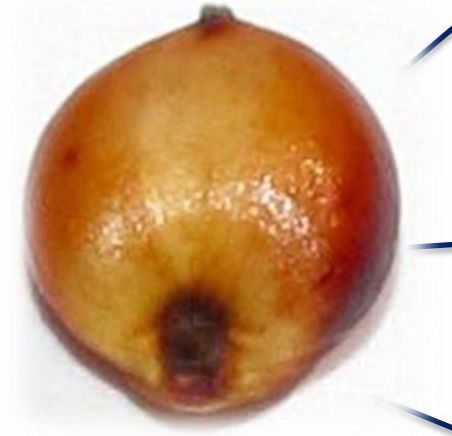
Chemical Composition

Sorghum Chemical Composition



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

Starch
- Important source of metabolizable energy and substrates

Oil
- Supplies energy and fatty acids
- Important co-product of value-added processing

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

Influenced by genetics, weather and crop yields

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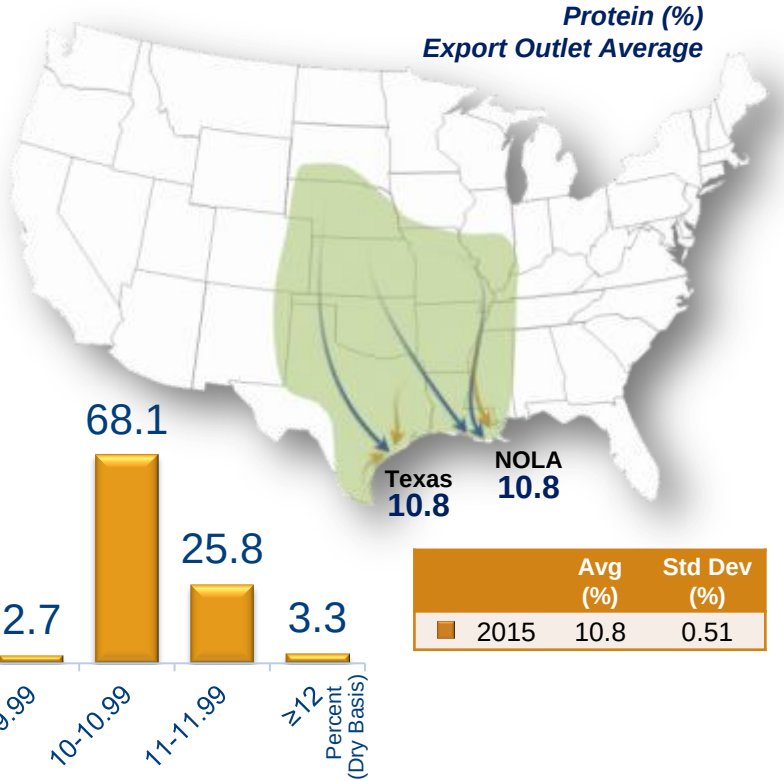
Chemical Composition Factors

	No. of Samples	Avg.	Std. Dev.	Min.	Max.
Protein (Dry Basis %)	182	10.8	0.51	9.7	12.6
Starch (Dry Basis %)	182	73.0	0.38	71.4	75.0
Oil (Dry Basis %)	182	4.5	0.13	3.7	4.9

Protein (Dry basis %)

U.S. Aggregate: 10.8%

- Within range of protein concentration values for U.S. sorghum hybrids
- 94% were between 10 and 11.99% protein concentration
- No noticeable differences between Export Outlets



	Avg (%)	Std Dev (%)
2015	10.8	0.51

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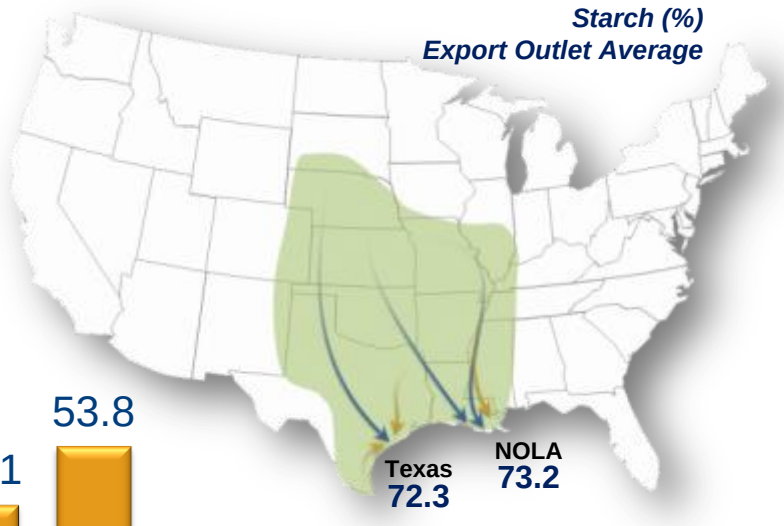
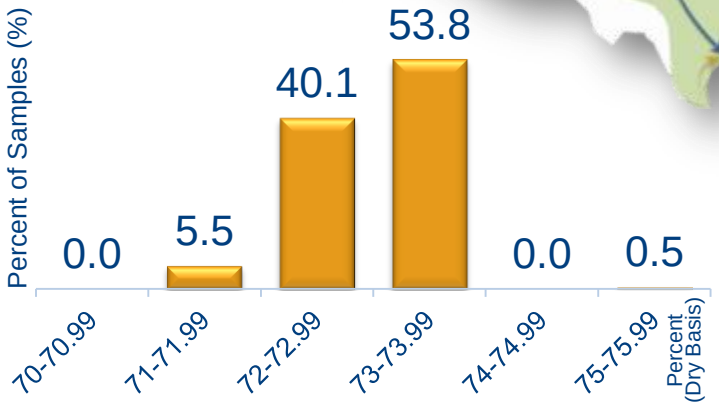
Starch (Dry basis %)

U.S. Aggregate: 73.0%

- Typical level for any sorghum crop
- 94% were between 72 and 73.99% starch concentration
- NOLA average was higher than Texas average





	Avg (%)	Std Dev (%)
2015	73.0	0.38

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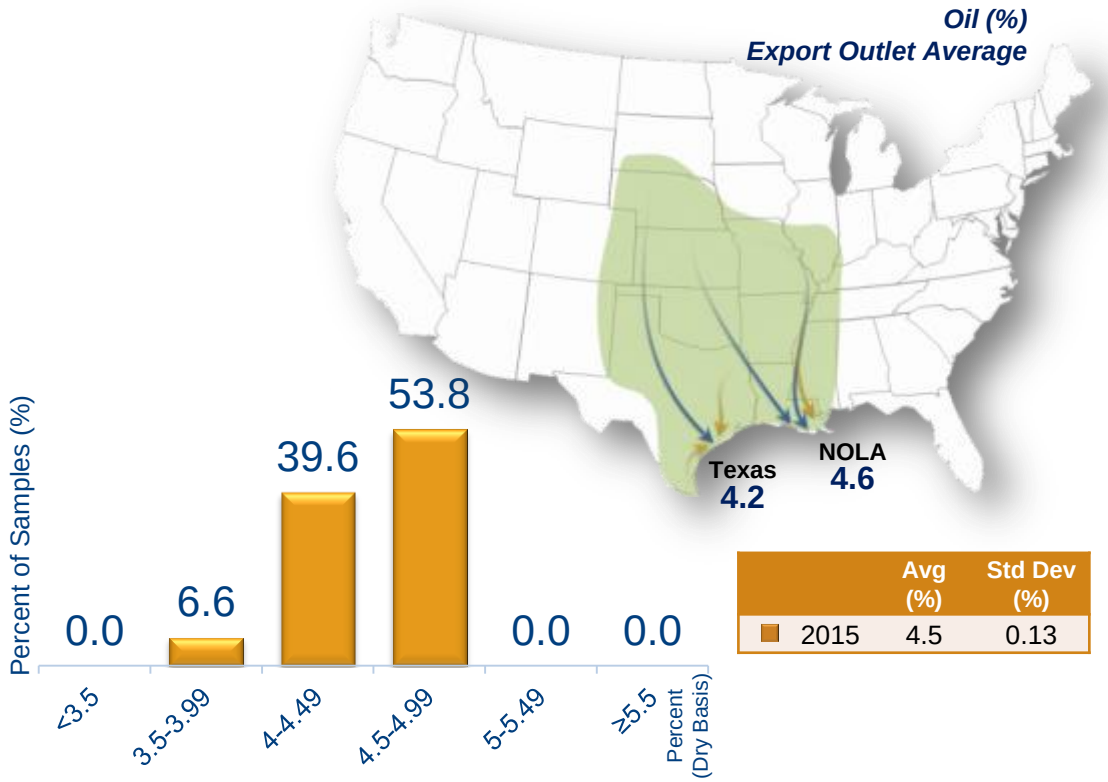
Oil (Dry basis %)

U.S. Aggregate: 4.5%

- Within range of oil concentration values for U.S. sorghum hybrids
- 93% were between 4 and 4.99% oil concentration
- NOLA average higher than Texas average



	Avg (%)	Std Dev (%)
2015	4.5	0.13

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Tannins Testing

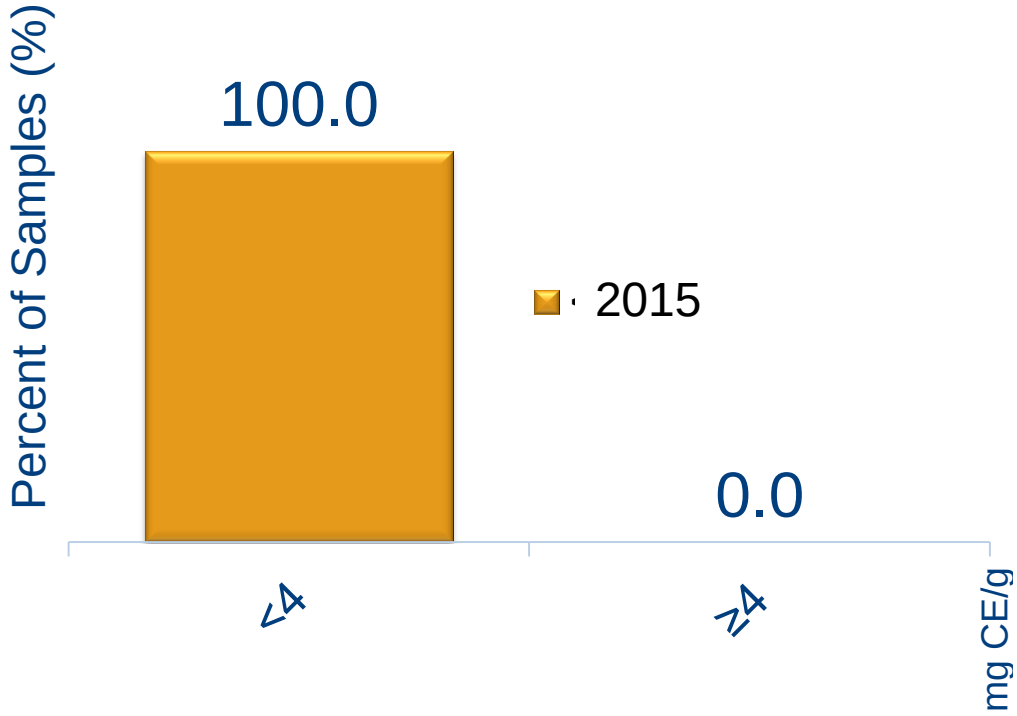
Quantitative test (levels to indicate presence of tannins) was used instead of qualitative test (Yes or No) for more accurate results.

- Values near or below 4.0 mg catechin equivalents (CE) per one g sample by this method generally imply absence of condensed tannins.[1,2]
- Type III tannin sorghums usually have values greater than 8.0 mg CE/g.

[1]Awika, J.M., L.W. Rooney, 2004. Sorghum phytochemicals and their potential impact on human health. Phytochemistry 65, 1199-1221.
[2]Price, Martin L., Van Scoyoc, S., Butler, L.G., 1978. A critical evaluation of vanillin reaction as an assay for tannin sorghum. Journal of Agricultural and Food Chemistry 26, 1214-1218.

Tannins (mg CE/g)

- 100% of U.S. export sorghum samples were below the threshold of 4.0 mg CE/g
- All samples considered tannin-free



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Physical Factors

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Physical Factors – Overview

Related to processing characteristics, storability and potential for breakage

- Kernel weight, volume and density
- Kernel diameter
- Kernel hardness index

Physical Factors

	No. of Samples	Avg.	Std. Dev.	Min.	Max.
Kernel Diameter (mm)	182	2.60	0.04	2.47	2.71
TKW (g)	182	27.57	0.85	24.28	30.02
Kernel Volume (mm^3)	182	20.28	0.66	17.91	22.12
True Density (g/cm^3)	182	1.360	0.012	1.333	1.496
Kernel Hardness Index	182	71.3	2.3	55.6	79.8

Kernel Weight, Volume, Density

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

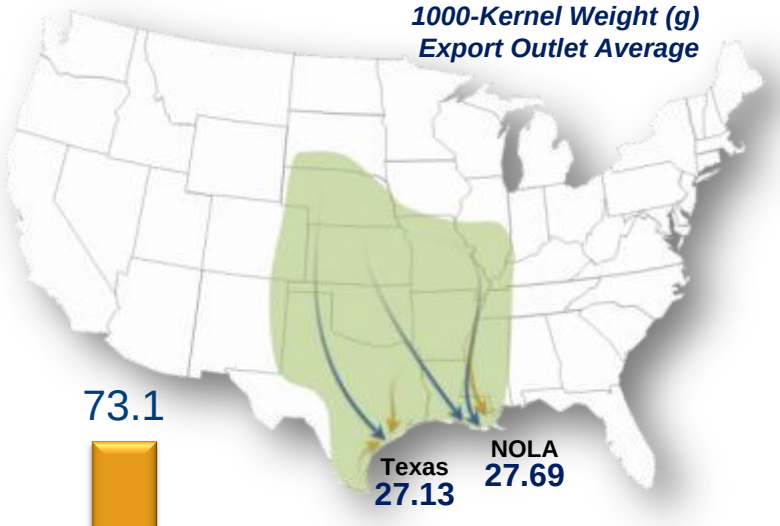
$$\frac{\text{1000-Kernel Weight (TKW) (mass) (g)}}{\text{Kernel Volume (mm}^3\text{) X } \frac{1\ \text{cm}^3}{1000\ \text{mm}^3}} = \text{True Density (g/cm}^3\text{)}$$

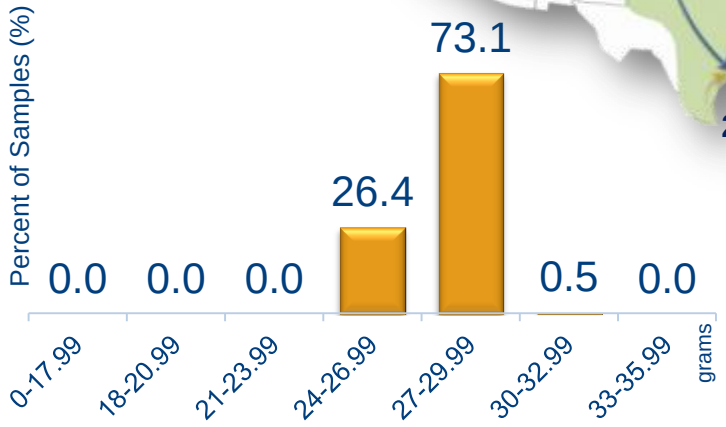
- True density reflects kernel hardness
- Higher density – harder kernels; less susceptible to breakage
- Lower density – softer kernels; process well in size reduction; good for feed use

1000-kernel Weight (TKW) (g)

U.S. Aggregate: 27.57 g

- Typical value for U.S. sorghum
- Higher than U.S. Harvest Aggregate average (26.30 g), with much less variation
- 99% were between 24 and 29.99 g
- NOLA average higher than Texas average





	Avg (g)	Std Dev (g)
2015	27.57	0.85

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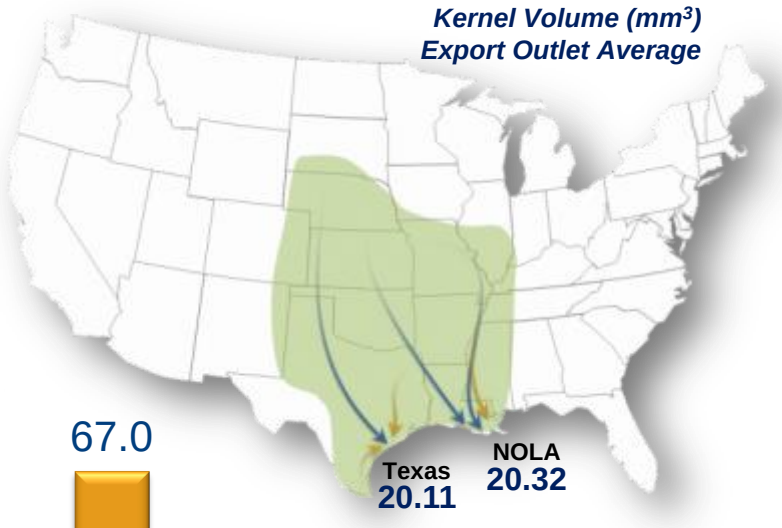
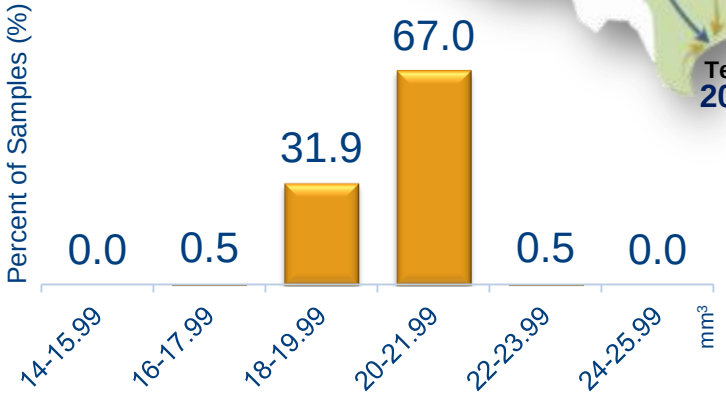
Kernel Volume (mm^3)

U.S. Aggregate: 20.28 mm^3

- On the lower end for kernels from any sorghum crop
- Higher than U.S. Aggregate Harvest average (19.34 mm^3), but less variation
- 99% were between 18 and 21.99 mm^3





	Avg (mm^3)	Std Dev (mm^3)
2015	20.28	0.66

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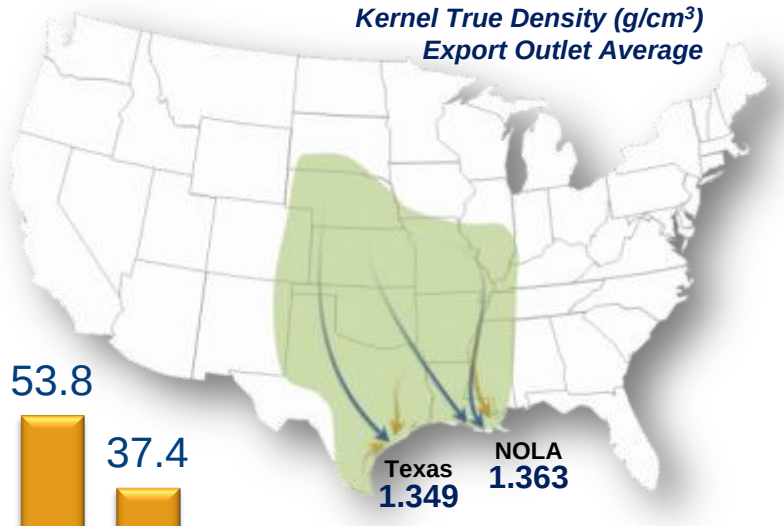
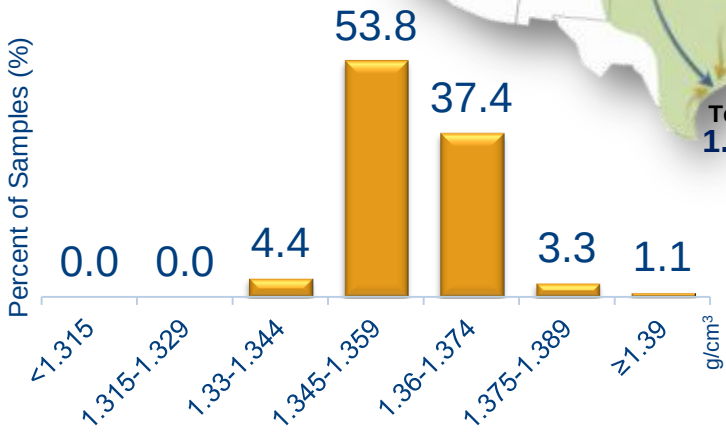
Kernel True Density (g/cm^3)

U.S. Aggregate: 1.360 g/cm^3

- Typical values for kernels from any sorghum crop
- Average within range of feed sorghum
- 91% were between 1.345 and 1.374 g/cm^3
- NOLA average higher than Texas average





	Avg (g/cm³)	Std Dev (g/cm³)
2015	1.360	0.012

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Other Physical Properties

Kernel Diameter

- Directly correlated with kernel volume
- Impacts size reduction behavior and material handling practices
- May indicate maturity of kernel

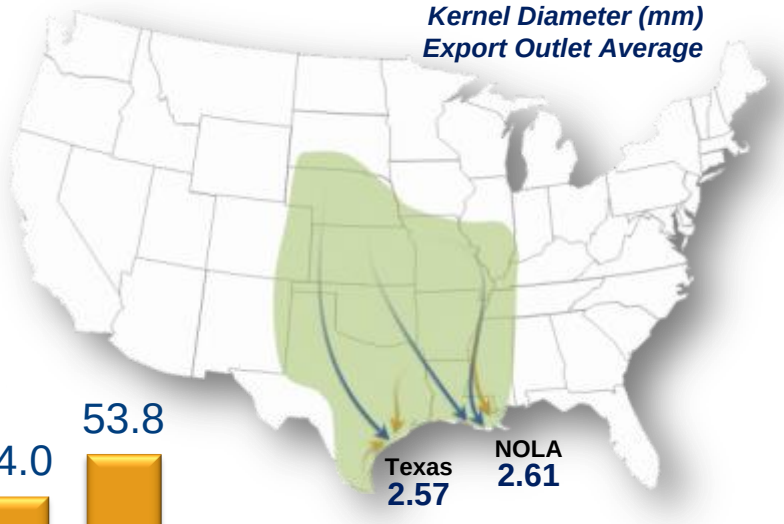
Kernel Hardness Index

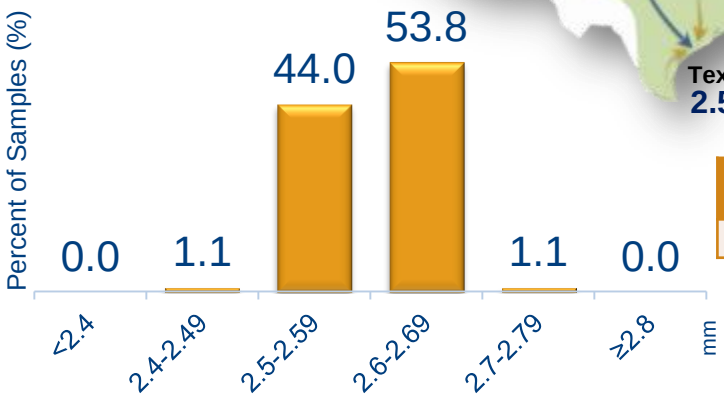
- The higher the value, the harder the kernel
- Impacts end-use of sorghum

Kernel Diameter (mm)

U.S. Aggregate: 2.60 mm

- Typical values for kernels from any sorghum crop
- Higher than U.S. Harvest Aggregate average (2.53 mm)
- 98% were between 2.5 and 2.69 mm





	Avg (mm)	Std Dev (mm)
2015	2.60	0.04

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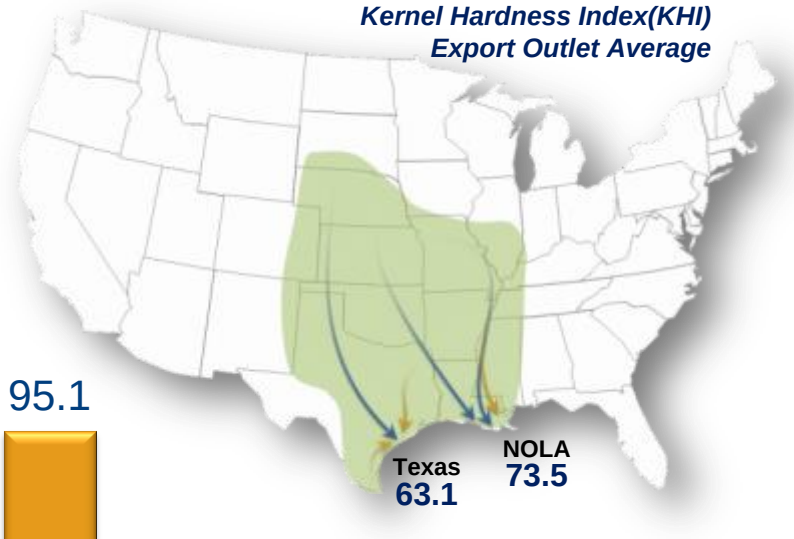
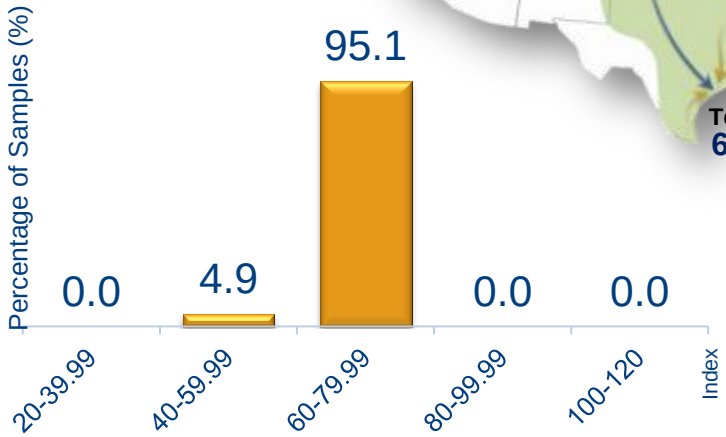
Kernel Hardness Index (KHI)

U.S. Aggregate: 71.3

- Average typical value for any sorghum crop
- Less variability than harvest samples
- NOLA average higher than Texas average





	Avg	Std Dev
2015	71.3	2.3

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Mycotoxins: Aflatoxins and DON

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Mycotoxin Testing

Export cargo sampling

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

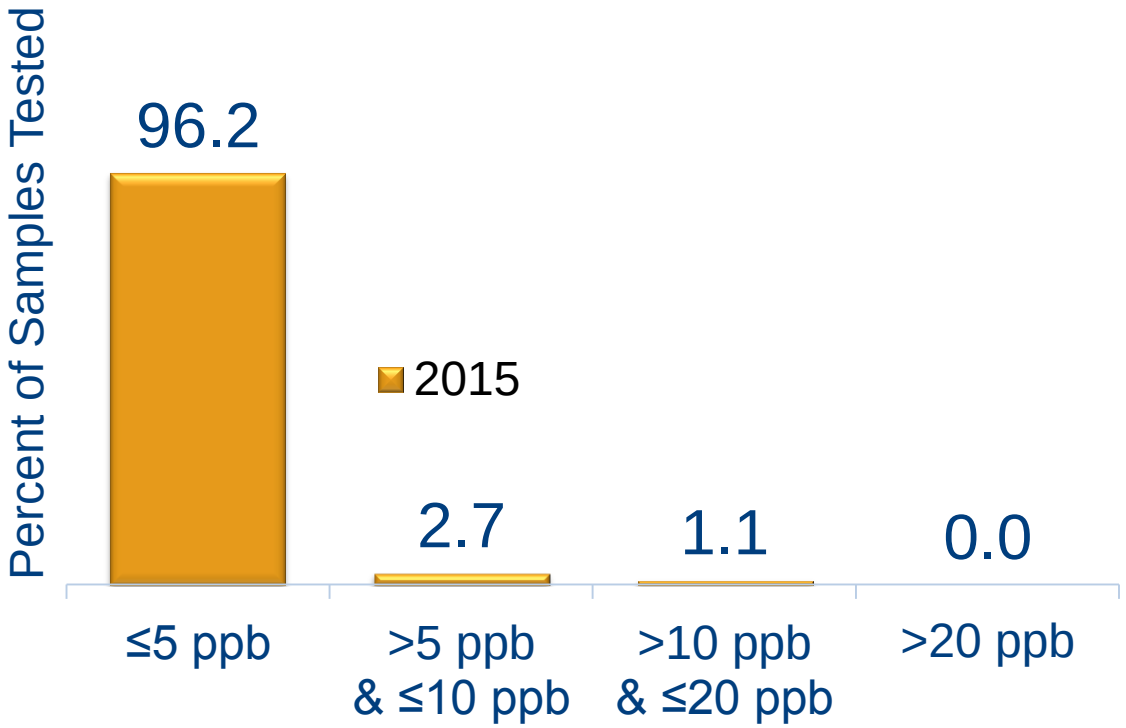
Reports ONLY the frequency of detected elevated levels of the mycotoxins in export samples

Positive results if above FGIS's "Lower Conformance Limit"

- Aflatoxins: 5.0 ppb
- DON: 0.5 ppm

Aflatoxins Testing Results

- 96.2% had no detectable levels (≤5 ppb) of aflatoxins
- All samples below the FDA action level of 20 ppb



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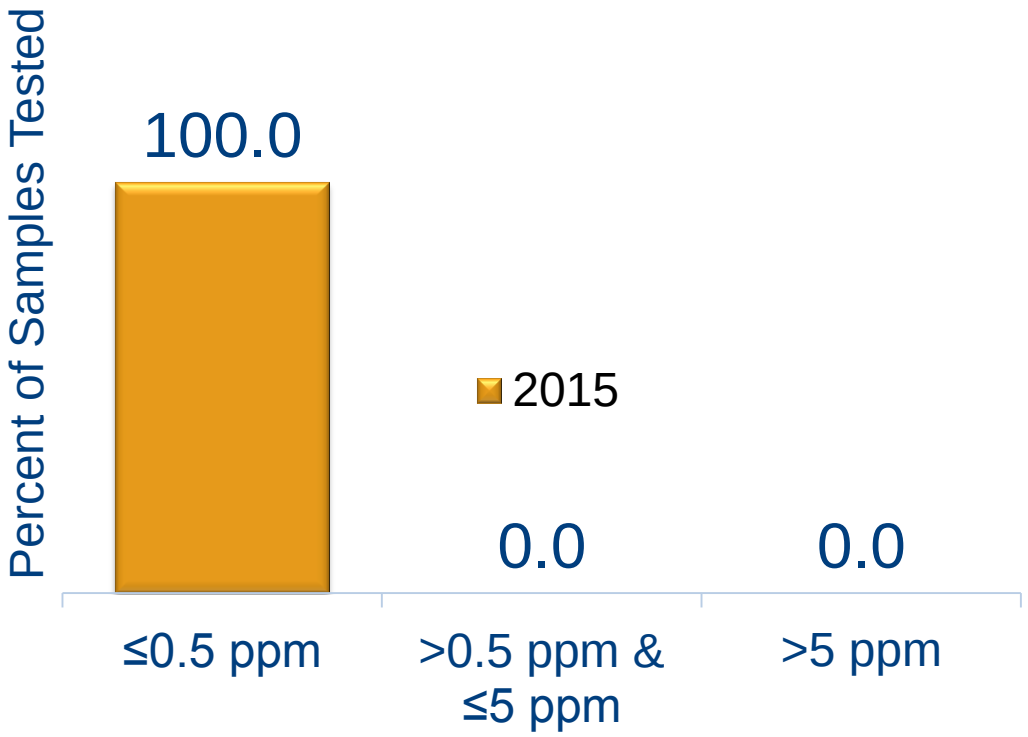
DON Testing Results

- 100% had no detectable levels (≤0.5 ppm) of DON
- All samples below the FDA advisory level of 5 ppm



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Export Cargo Quality Conclusions

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Export Cargo Quality Conclusions

- 2015/2016 early export samples were, on average, very good with 98% grading U.S. No. 2 or better
- More uniformity in grade factors than for harvest samples
- Average moisture at acceptable level for safe storage
- Average U.S. Aggregate values for protein and starch were slightly lower at export than harvest whereas oil was unchanged
- Sorghum export samples were tannin-free
- Average U.S. Aggregate values for all physical factors were somewhat higher at export than at harvest
- No aflatoxin and DON levels exceeding FDA action and advisory levels, respectively

Other Components of the Sorghum Harvest & Export Cargo Quality Report

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Other Features of the Report

- Harvest Quality Test Results
- Crop and Weather Conditions
- U.S. Sorghum Export System
- U.S. Sorghum Production, Usage and Outlook
- Survey and Statistical Analysis Methods
- Testing Analysis Methods

Tool for Better Decision Making

Sorghum Quality	**Harvest** – impacted by several factors including geography, genetics and weather **Export** – affected by many factors in the U.S. grain marketing system, in addition to building on the quality established at harvest
Understanding Quality	Provides information for evaluating patterns in quality across geographies, how weather affects quality, and changes in quality between harvest and export
Report Value	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 will surface

Building a Tradition: Thank You!

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SUPPLEMENTAL SLIDES: U.S. Grains Council 2015/2016 Sorghum Export Cargo Quality

[Insert Date]
[Insert Location]

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Sorghum Exports

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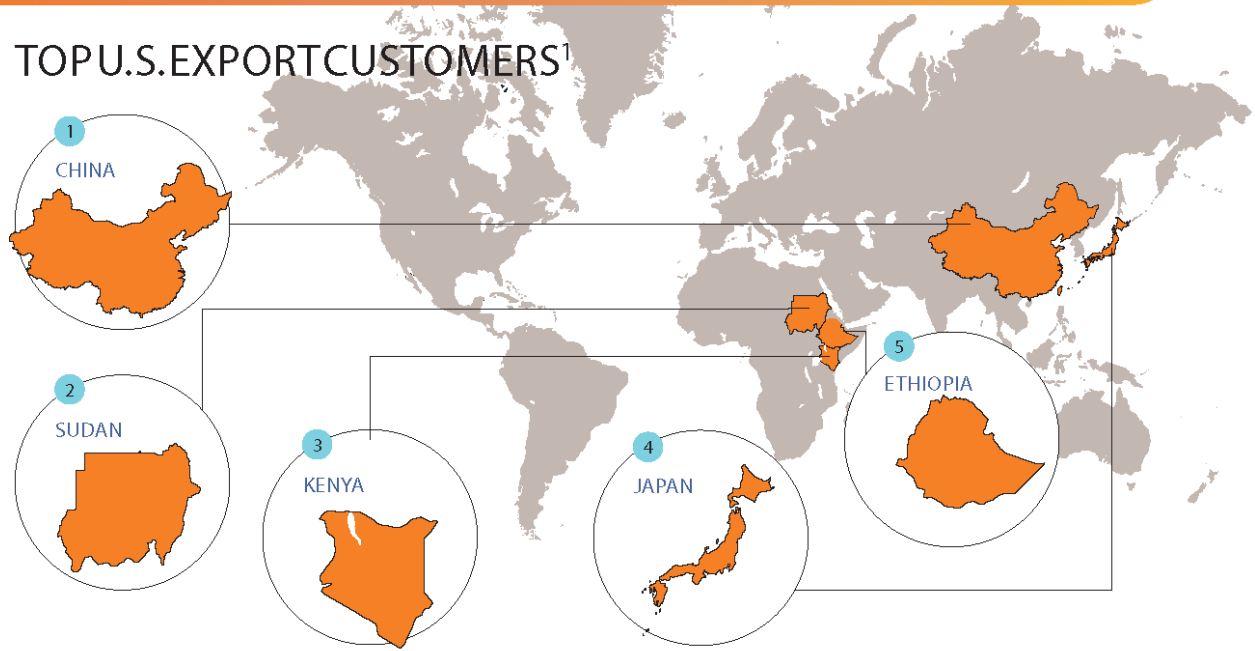
Where is U.S. Sorghum Going?

TOP U.S. EXPORT CUSTOMERS[1]



Dollar amount

1	CHINA	$1.97 BILLION
2	SUDAN	$51.8 MILLION
3	KENYA	$27.8 MILLION
4	JAPAN	$17.7 MILLION
5	ETHIOPIA	$12.8 MILLION

Metric tons

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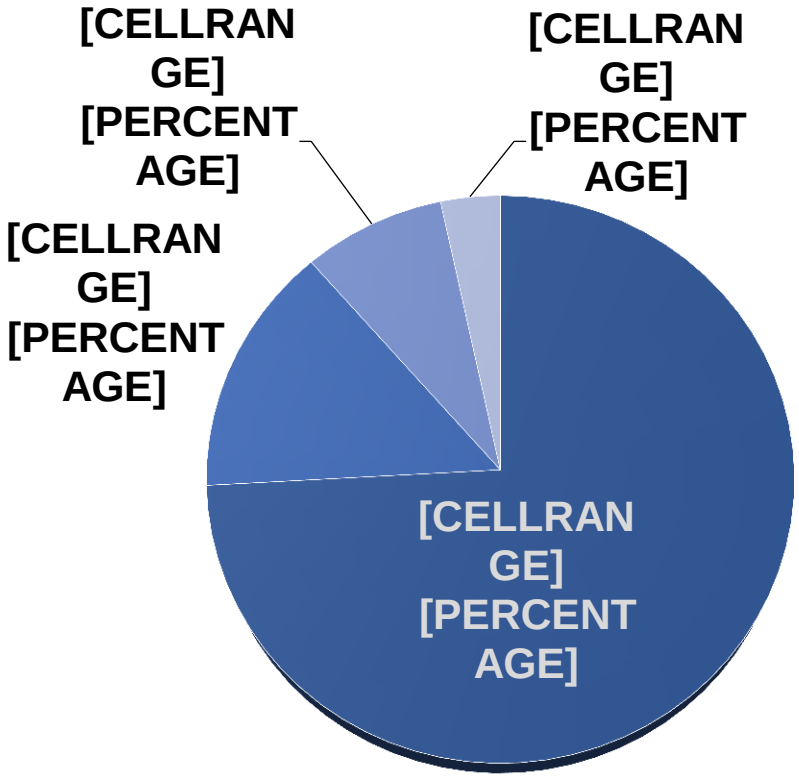
Source: [1]USDA Global Agricultural Trade System report for marketing year Sept 1, 2014 to Aug 31, 2015

Key Global Exporters (2015/2016P)



Source: USDA FAS P=Projected

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