2024/2025 Corn Export Cargo Quality Report

March 17, 2025

U.S. GRAINS COUNCIL

Quality, Reliability, Transparency

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Bridge to world's largest, most reliable grain supply

2024/2025 Corn Quality Report

Systematic survey of corn quality at harvest and of early exports

Transparent and Consistent Methodology

Reliable and Comparable Data

Harvest Quality Report

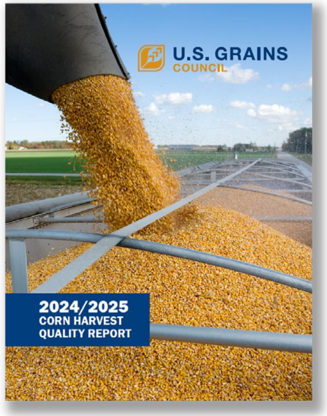
Export Cargo Quality Report

USGC Corn Quality Reports

2011/2012 through 2023/2024

2024/2025

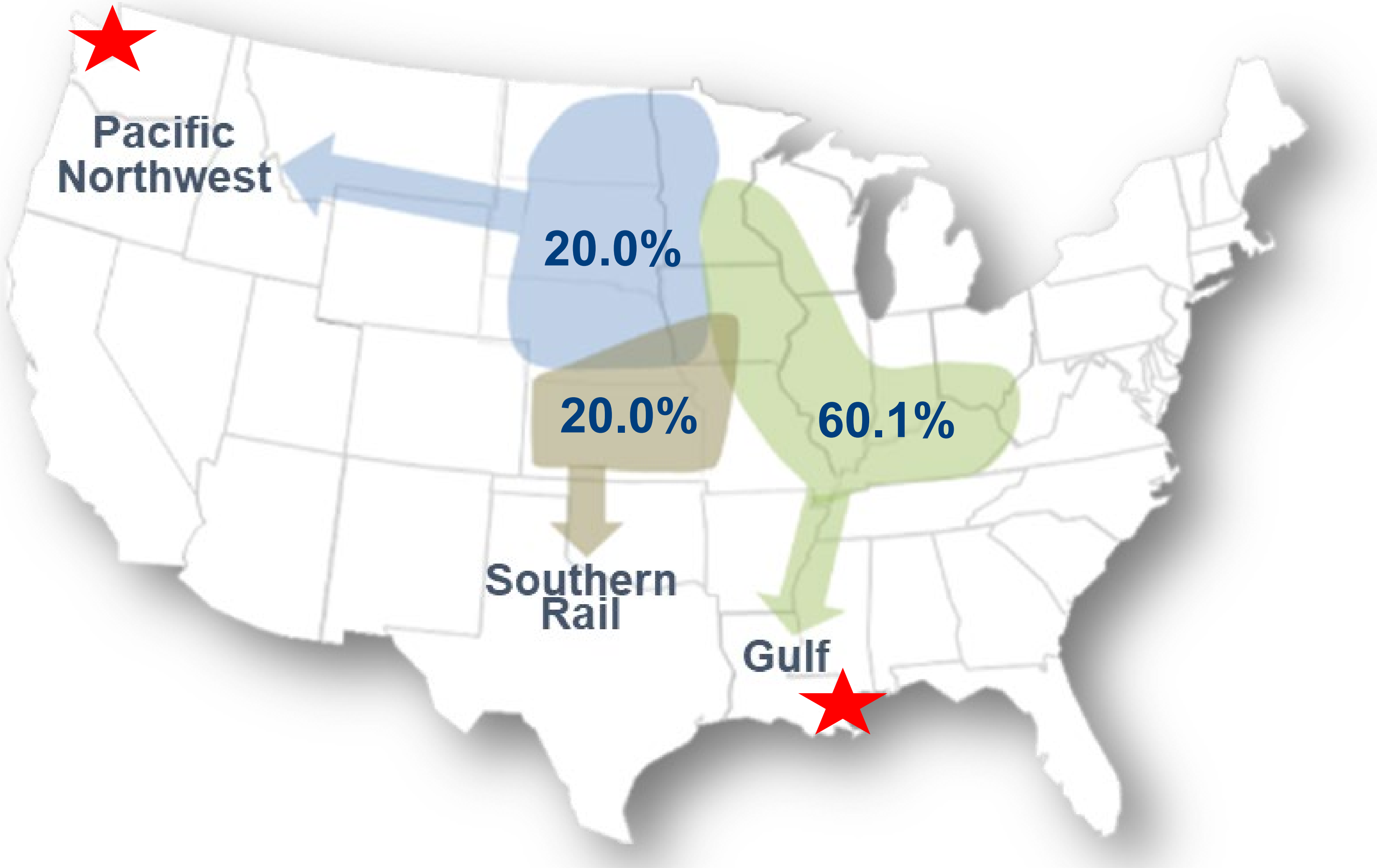
Harvest



Export Cargo

“Export Catchment Areas” (ECA)

430 export samples targeted from ECAs representing approximately 90% of U.S. Corn Exports



Quality Factors Tested

Grading Factors
- Test weight
- Broken corn
- Foreign material
- Total damage
- Heat damage

Physical Factors
- Stress cracks
- 100-kernel weight
- Kernel volume
- True density
- Whole kernels
- Horneous (hard) endosperm

Chemical Composition
- Protein
- Starch
- Oil

Mycotoxins
- Aflatoxin
- DON (Vomitoxin)
- Fumonisin
- Ochratoxin A
- T-2
- Zearalenone

2024/2025 Corn Export Cargo Quality Report Highlights

Overall Crop	Grade Factors/ Moisture vs. 5YA	Chemical Composition vs. 5YA	Physical Factors vs. 5YA	Mycotoxins
Aggregate average BCFM lower than maximum limit for U.S. No. 2 Aggregate average Test Weight, Total Damage and Heat Damage rated U.S. No. 1 or better	Test Weight **Higher** BCFM **Lower** Total Damage **Lower**	Protein **Same** Starch **Higher** Oil **Lower**	Stress Cracks **Similar** 100-Kernel Weight **Higher** True Density **Higher** Whole Kernels **Higher**	**100.0**% of samples ≤ FDA action level for Aflatoxin‡ **100.0**% of samples below FDA advisory level for DON of 5.0 ppm ‡ **97.8**% of samples ≤ the lowest FDA Fumonisin advisory level of 5 ppm‡

†5YA = Marketing years 2019/2020 through 2023/2024

‡Action, advisory and guidance levels for corn intended for feed use

Grade Factors

Grades and Grade Requirements

Grade	Minimum Test Weight: Pounds per Bushel	Minimum Test Weight: Kilogram per Hectoliter	Maximum Limits of Damaged Kernels: Heat Damage (%)	Maximum Limits of Damaged Kernels: Total (%)	Maximum Limits of: BCFM (%)
U.S. No. 1	56.0	72.1	0.1	3.0	2.0
U.S. No. 2	54.0	69.5	0.2	5.0	3.0
U.S. No. 3	52.0	66.9	0.5	7.0	4.0
U.S. No. 4	49.0	63.1	1.0	10.0	5.0
U.S. No. 5	46.0	59.2	3.0	15.0	7.0

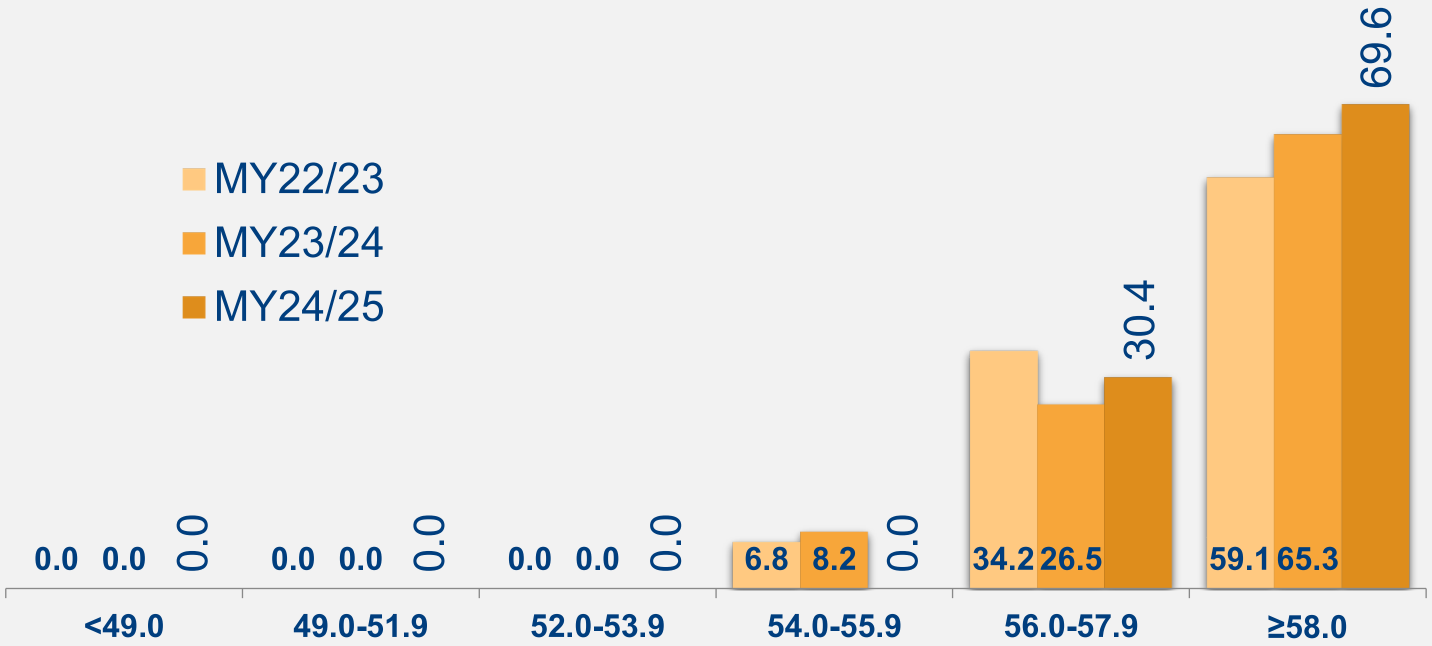
Grade Factors

	Number of Samples	Average	Standard Deviation	Minimum	Maximum
Test Weight (lb/bu)	393	58.3	0.62	56.1	60.3
Test Weight (kg/hl)	393	75.0	0.80	72.2	77.6
BCFM (%)	430	2.5	0.60	0.6	5.5
Total Damage (%)	430	1.8	0.68	0.2	7.9
Heat Damage (%)	430	0.0	0.01	0.0	0.1

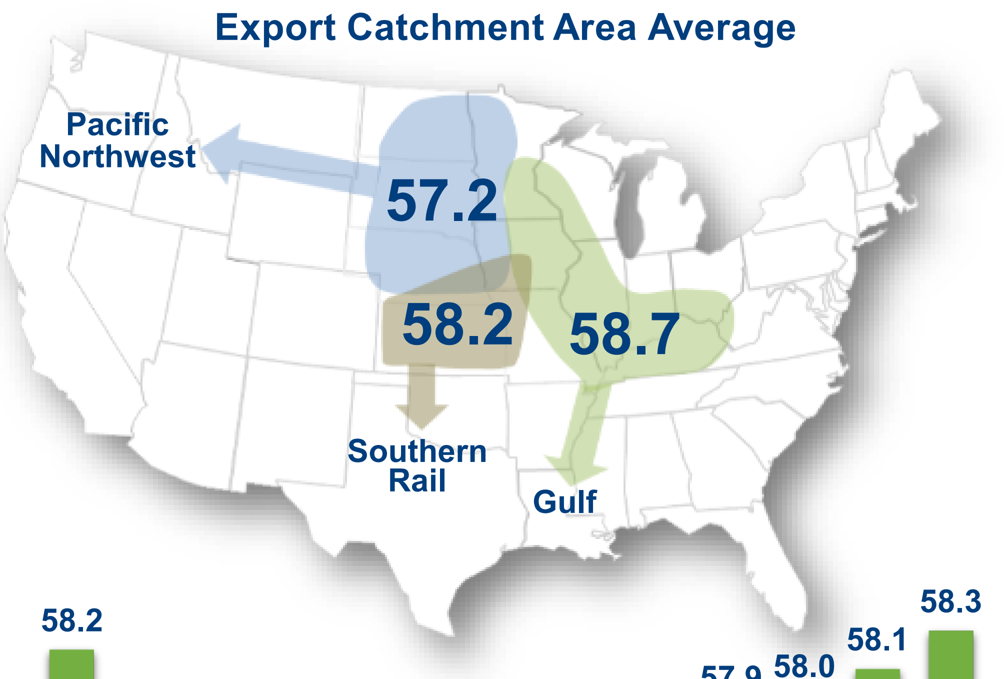
Test Weight – U.S. Units (lb/bu)

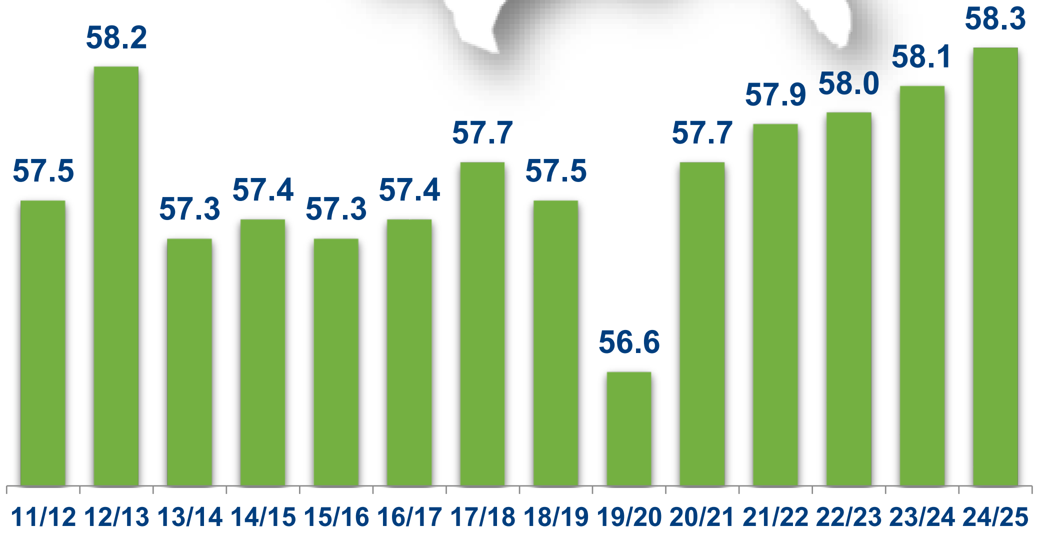
U.S. Aggregate: 58.3 lb/bu

- Average **higher** than the 5YA (57.6 lb/bu)
- **100.0%** No. 1 grade



Percent of Samples by Marketing Year



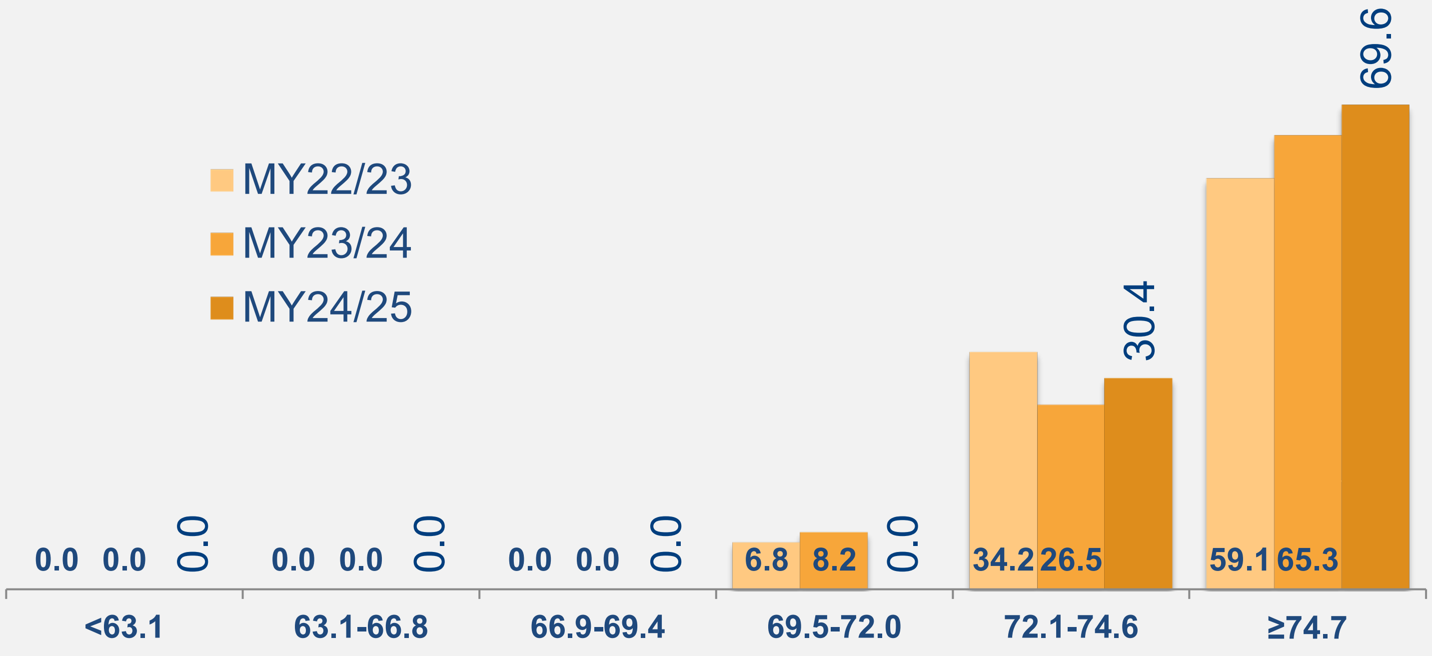


Historical Aggregate by Marketing Year

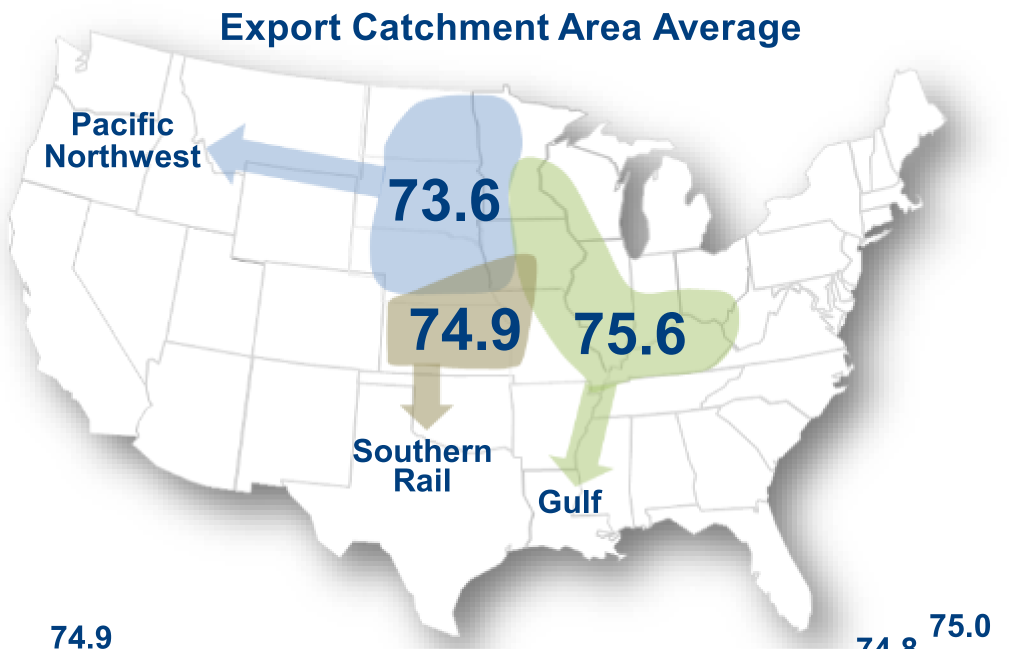
Test Weight – Metric (kg/hl)

U.S. Aggregate: 75.0 kg/hl

- Average **higher** than the 5YA (74.2 kg/hl)
- **100.0%** No. 1 grade

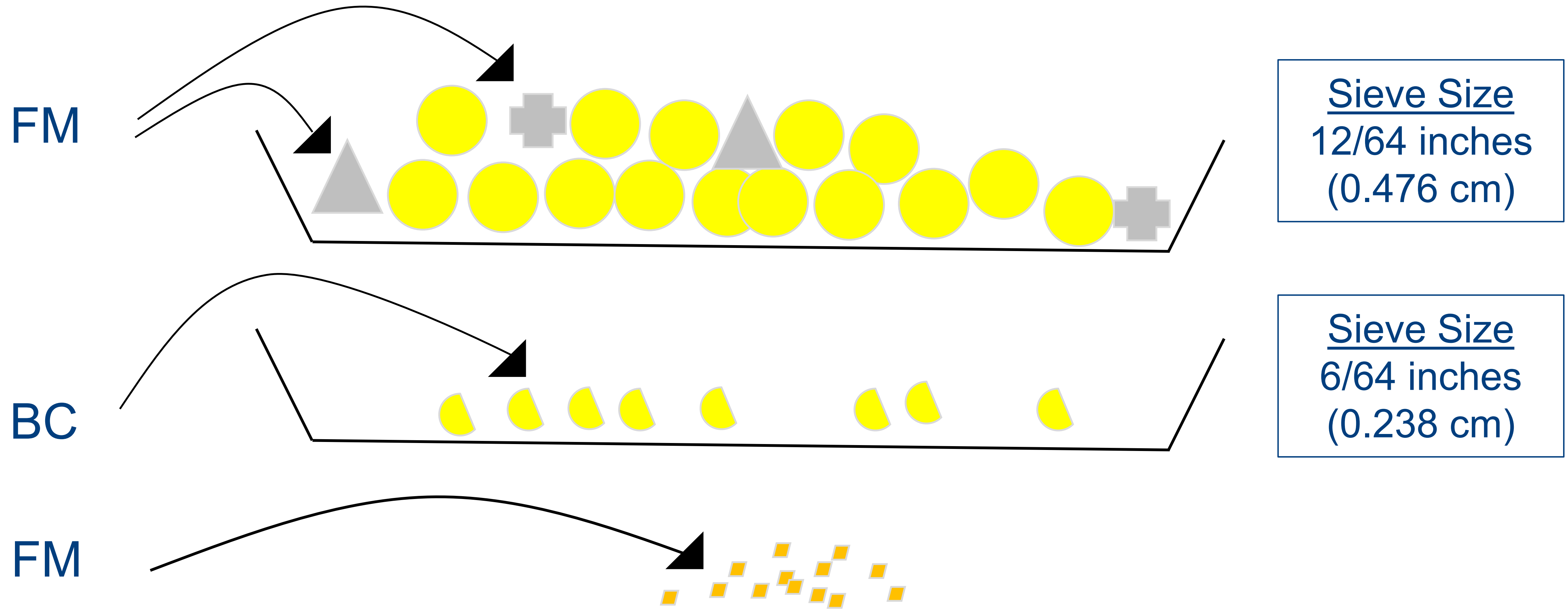


Percent of Samples by Marketing Year



Historical Aggregate by Marketing Year

Broken Corn and Foreign Material*

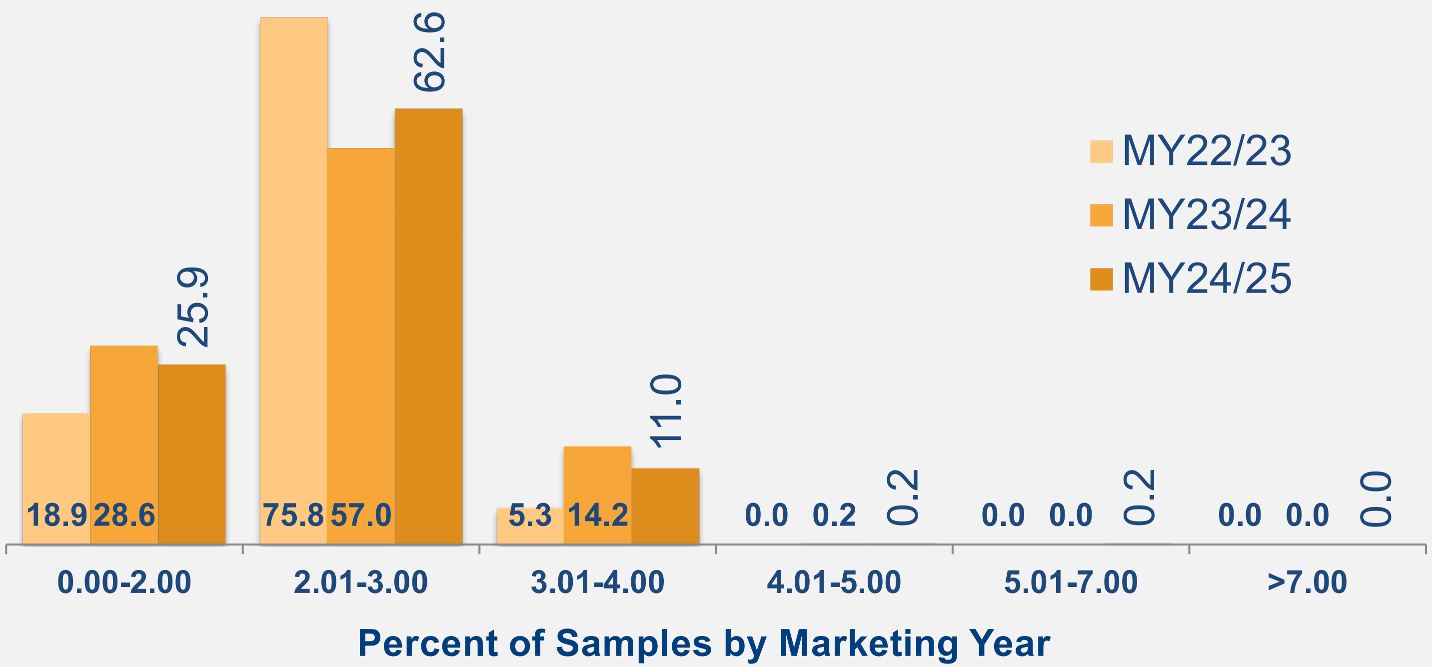


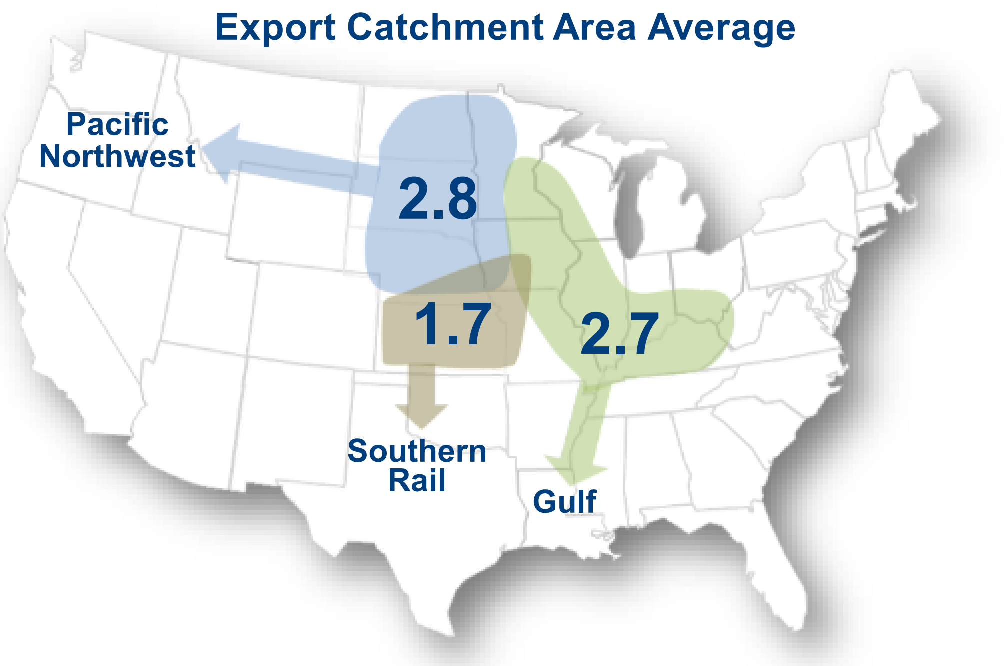
*Measured as percent of weight

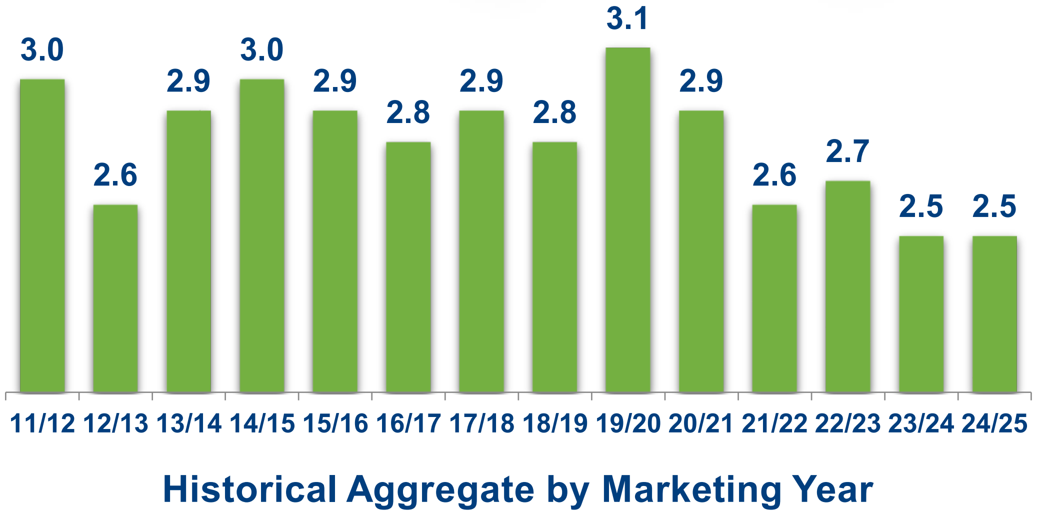
Broken Corn & Foreign Material (%)

U.S. Aggregate: 2.5%

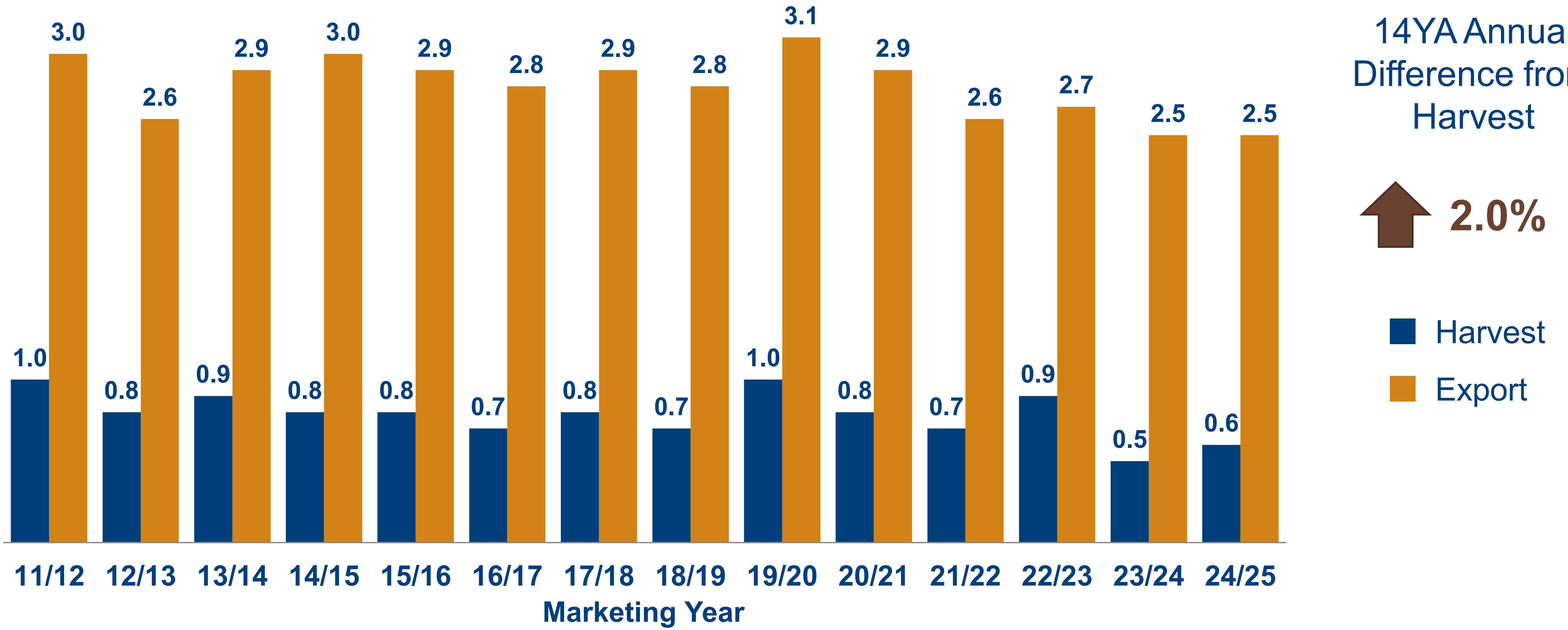
- **88.5%** No. 2 grade or better
- Average **lower** than the 5YA (2.7%)





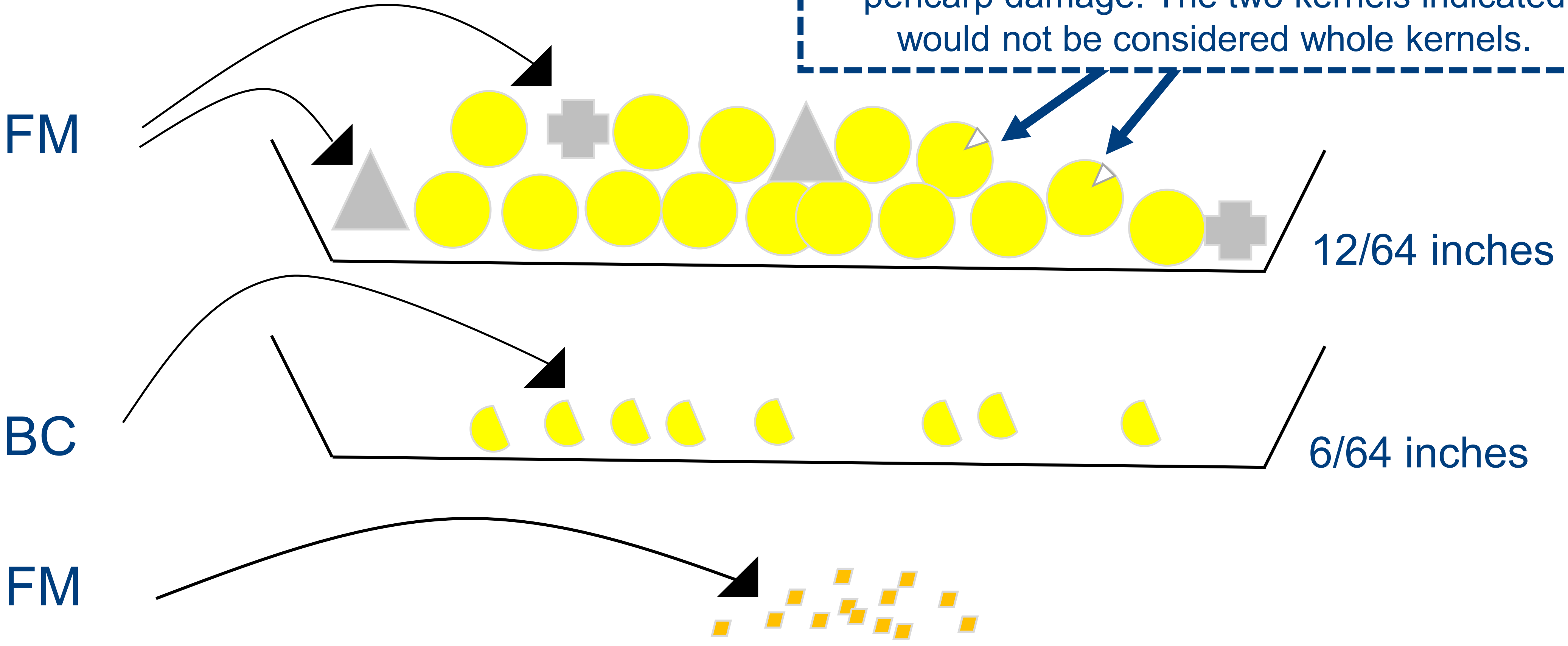


Harvest vs. Export Cargo
Broken Corn & Foreign Material (%)



Whole Kernels (%)

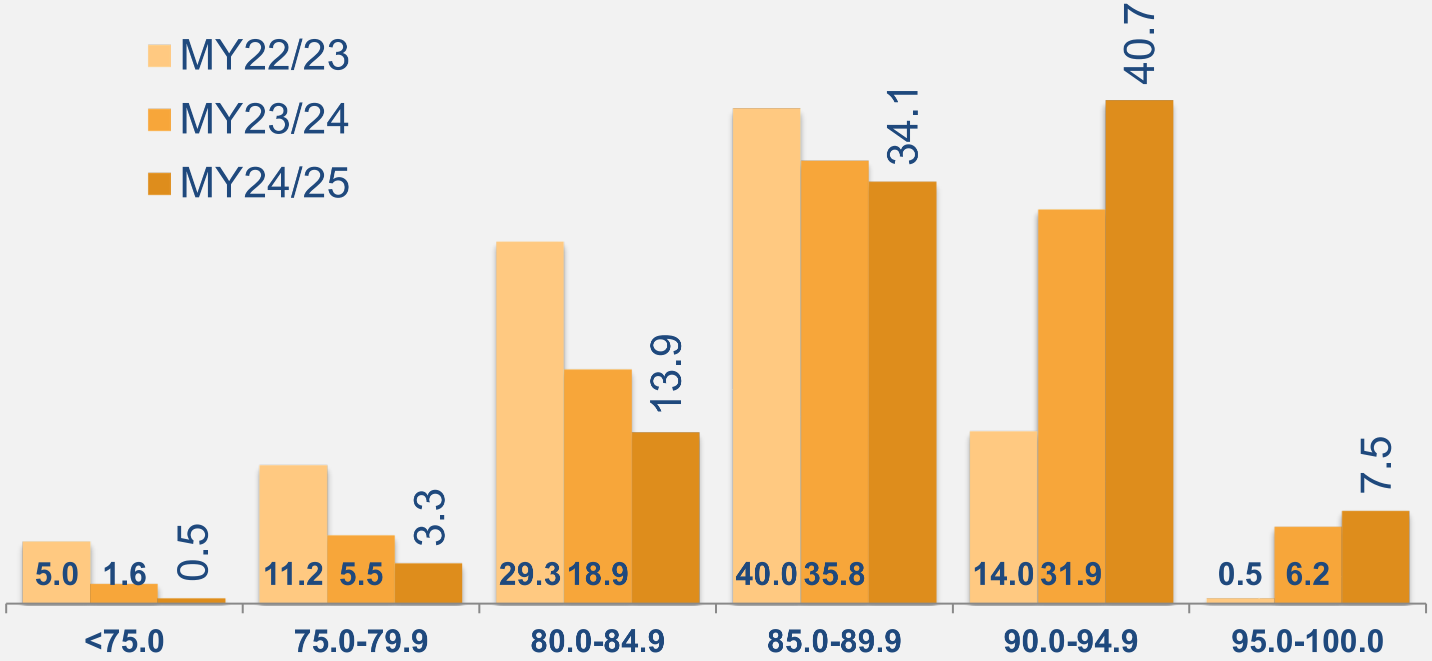
Whole kernels measures the percentage of BCFM-free kernels that are free of chips and pericarp damage. The two kernels indicated would not be considered whole kernels.



Whole Kernels (%)

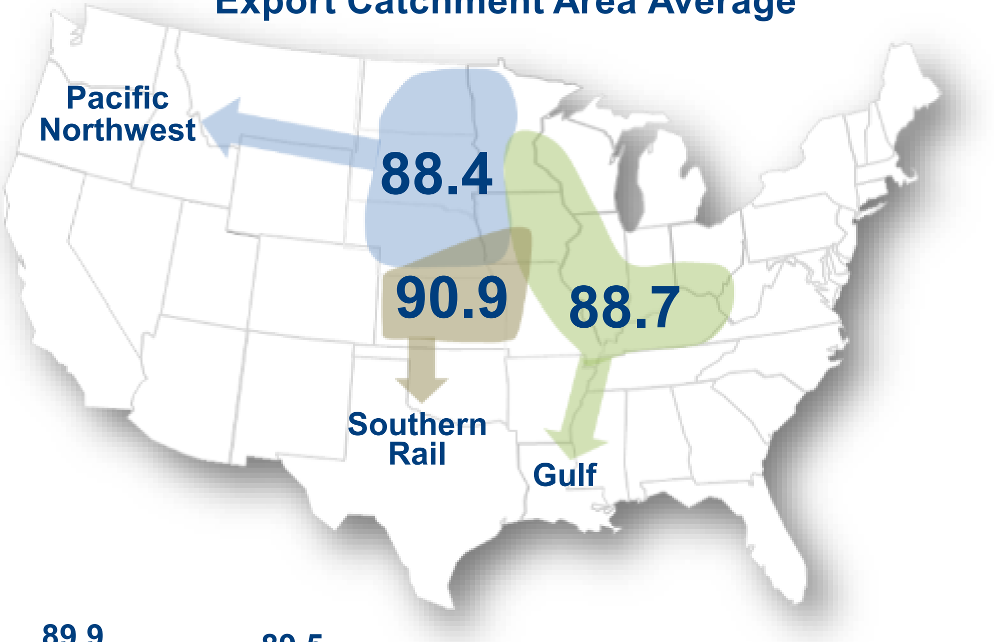
U.S. Aggregate: 89.1%

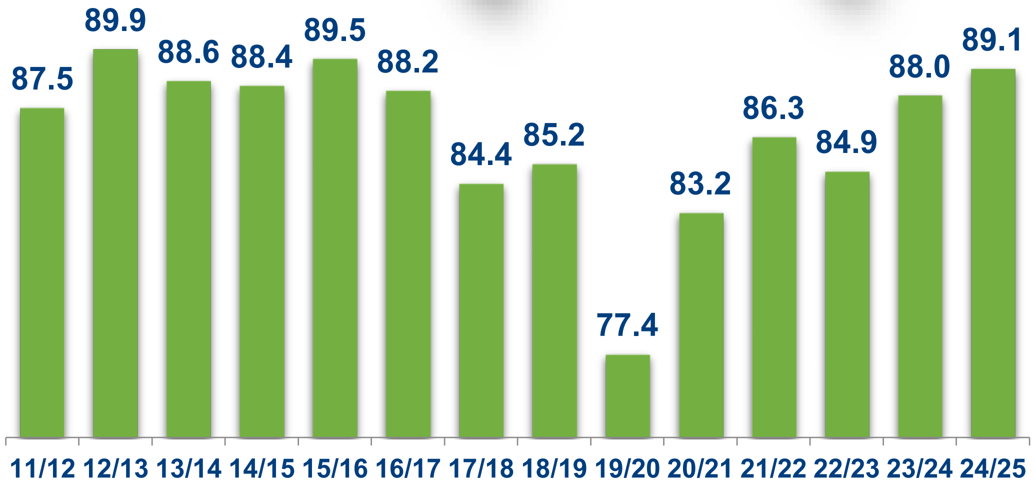
- Average **higher** than the 5YA (83.9%)



Percent of Samples by Marketing Year

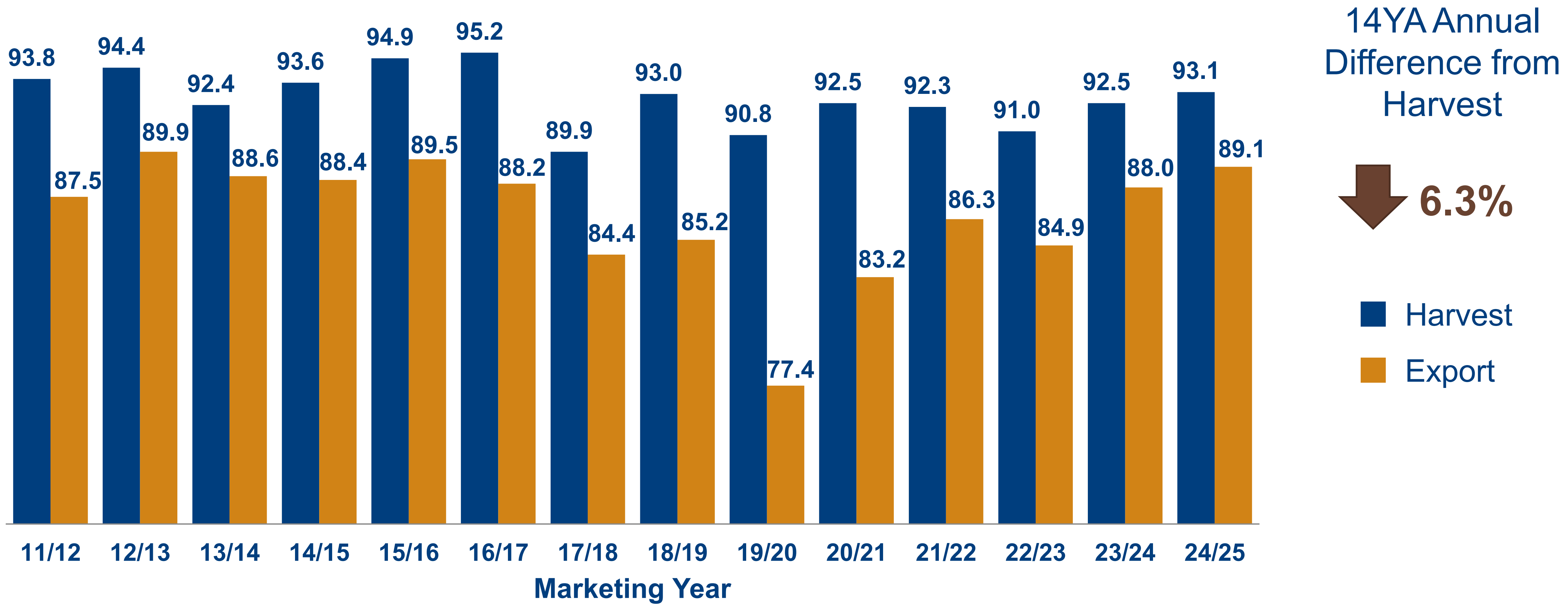
Export Catchment Area Average





Historical Aggregate by Marketing Year

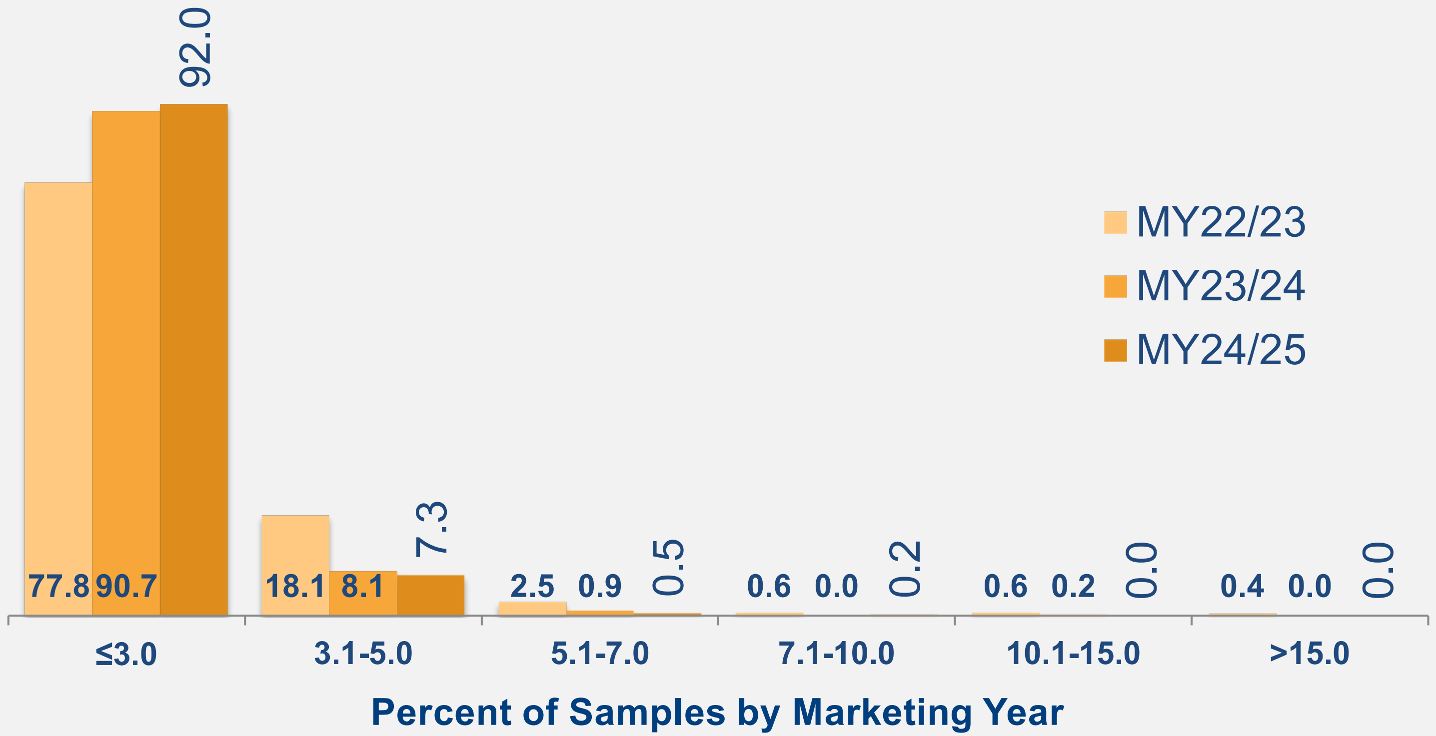
Harvest vs. Export Cargo Whole Kernels (%)

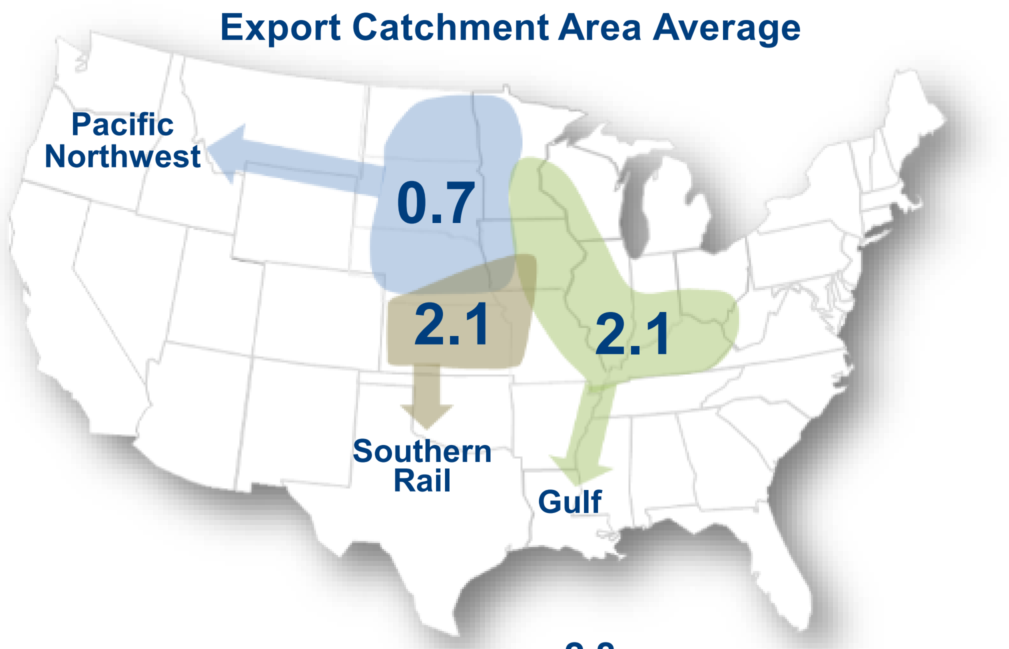


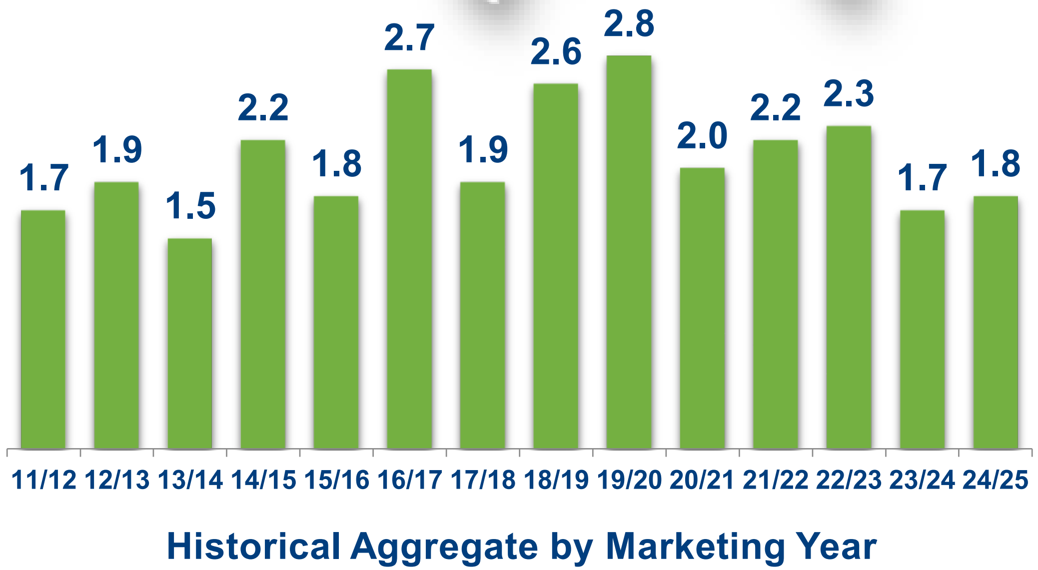
Total Damage (%)

U.S. Aggregate: 1.8%

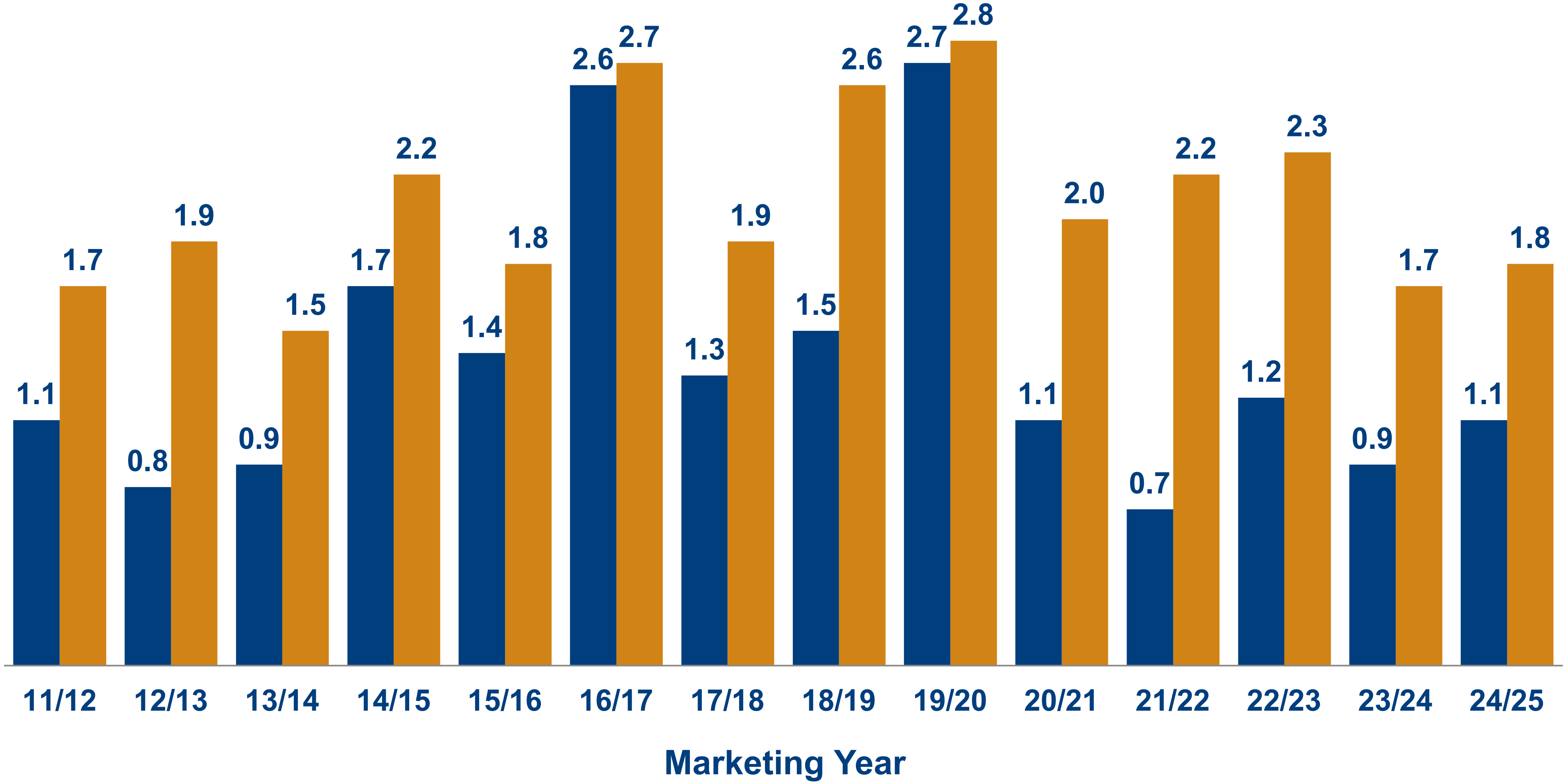
- Average **lower** than the 5YA (2.2%)
- **92.0%** No. 1 grade







Harvest vs. Export Cargo Total Damage (%)



14YA Annual Difference from Harvest

0.7%

Harvest

Export

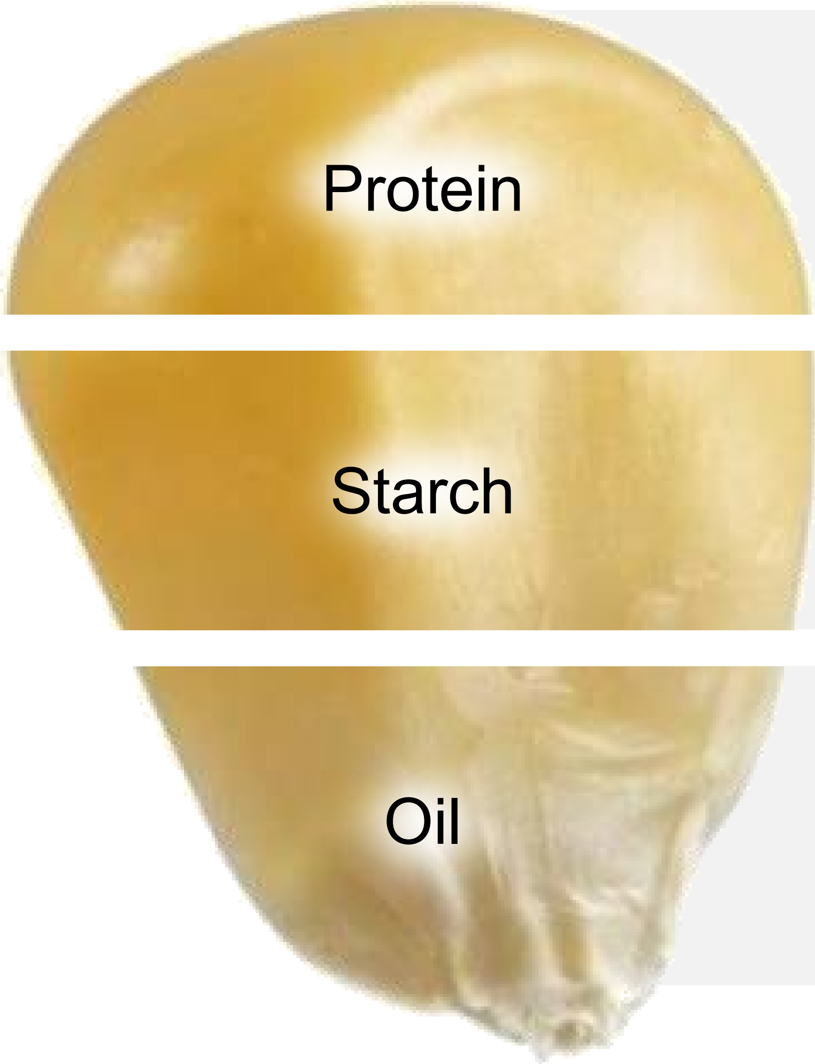
Heat Damage (%)

U.S. Aggregate: 0.0%

- Average **below** the limit for U.S. No. 1 Grade
- Only seven samples had heat damage higher than 0.0% (all seven were 0.1%)
- Indicates **good management** of the drying and storage of corn

Chemical Composition

Chemical Composition



		Influenced by
Protein	Important for poultry and livestock feeding Supplies essential amino acids	Genetics, weather, crop yields and available nitrogen during the growing season
Starch	Important for wet millers and dry-grind ethanol manufacturers	Genetics, weather and crop yields
Oil	Important by-product of wet and dry milling Essential feed component	Genetics, weather and crop yields

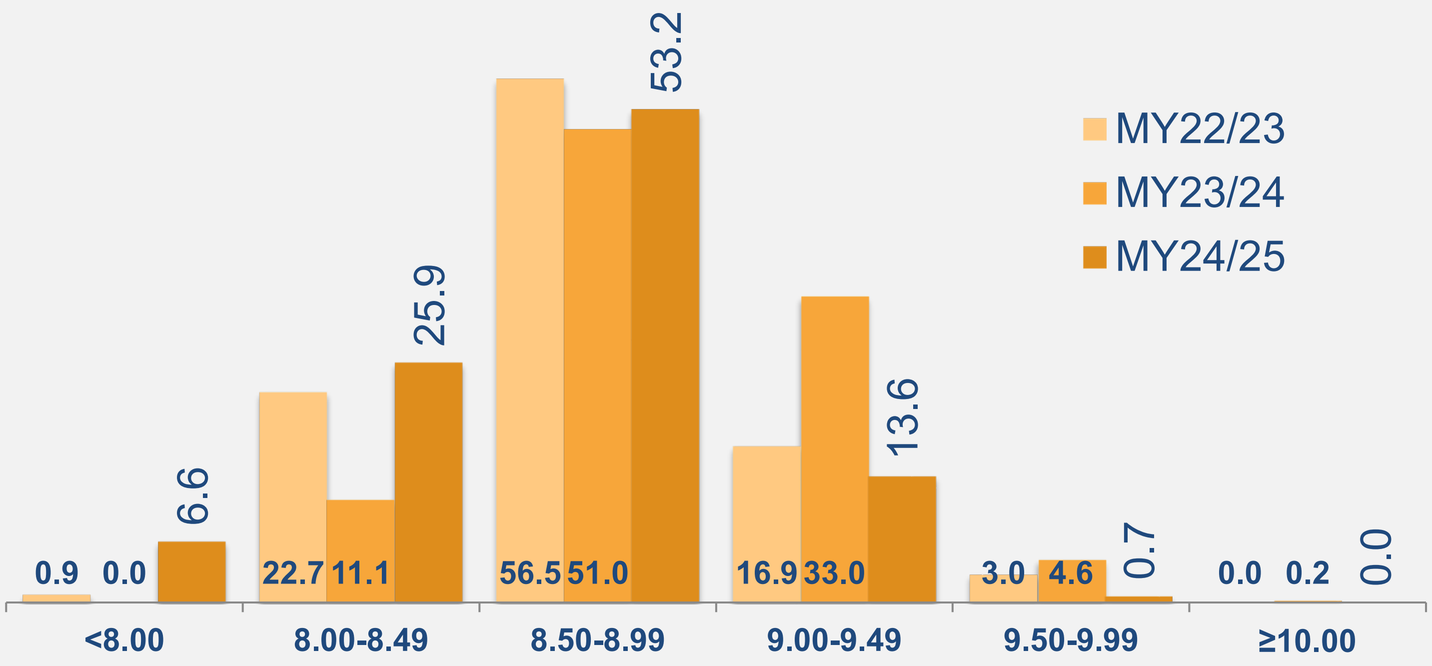
Chemical Composition

	Number of Samples	Average	Standard Deviation	Minimum	Maximum
Protein (Dry Basis %)	425	8.6	0.35	7.3	9.9
Starch (Dry Basis %)	425	72.1	0.38	70.8	73.3
Oil (Dry Basis %)	425	3.9	0.12	3.5	4.2

Protein (Dry Basis %)

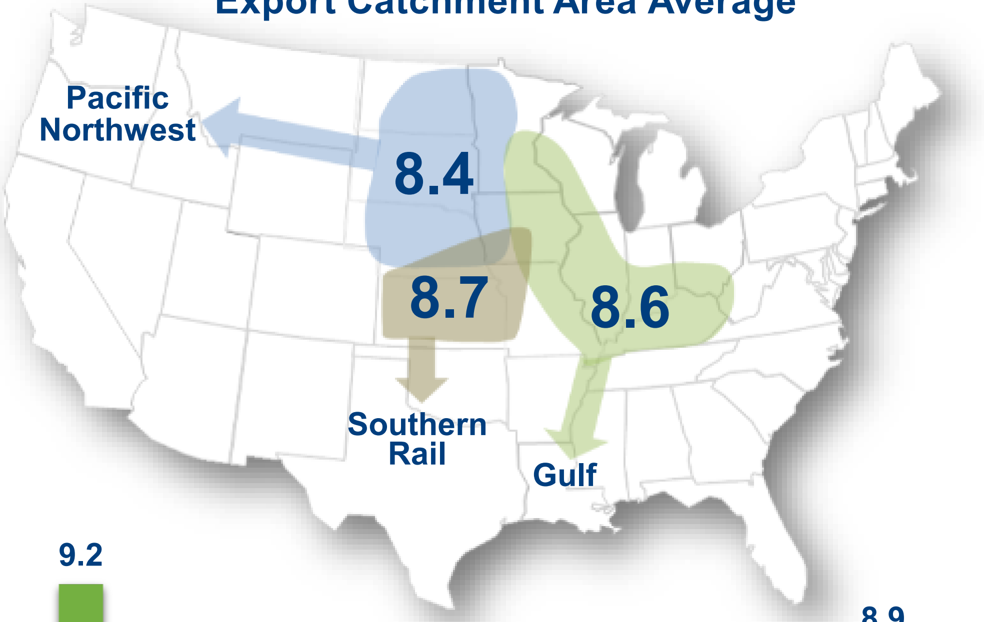
U.S. Aggregate: 8.6%

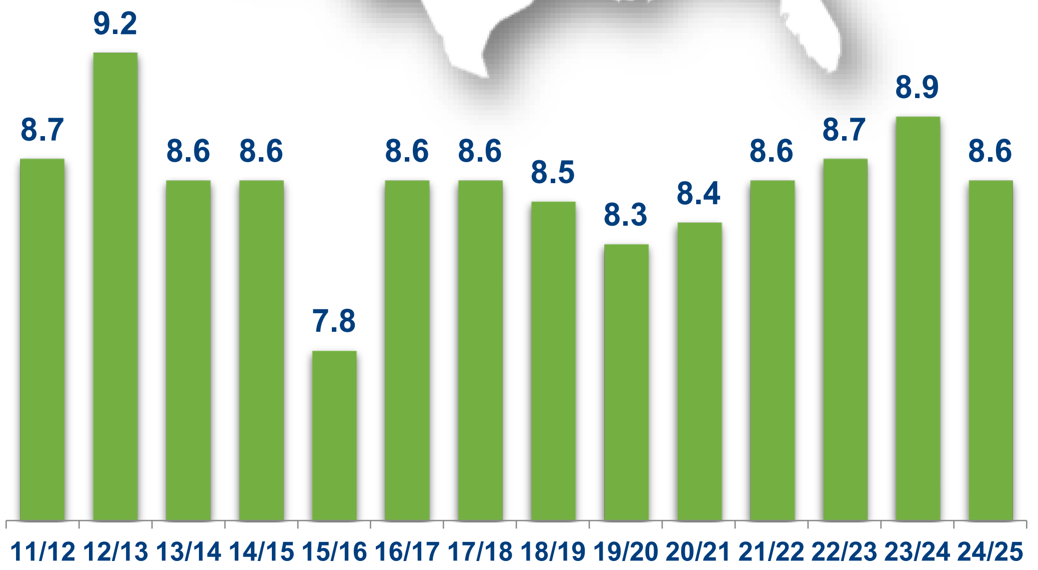
- Average **same** as the 5YA



Percent of Samples by Marketing Year

Export Catchment Area Average



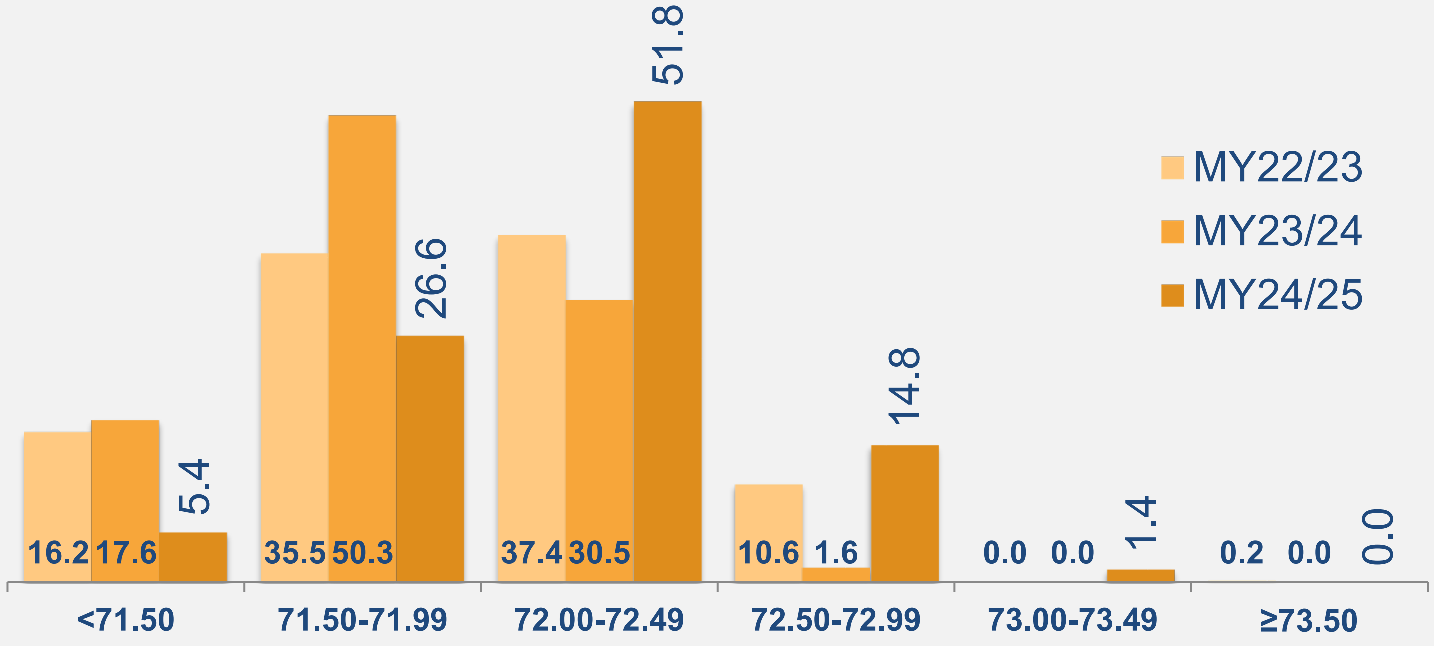


Historical Aggregate by Marketing Year

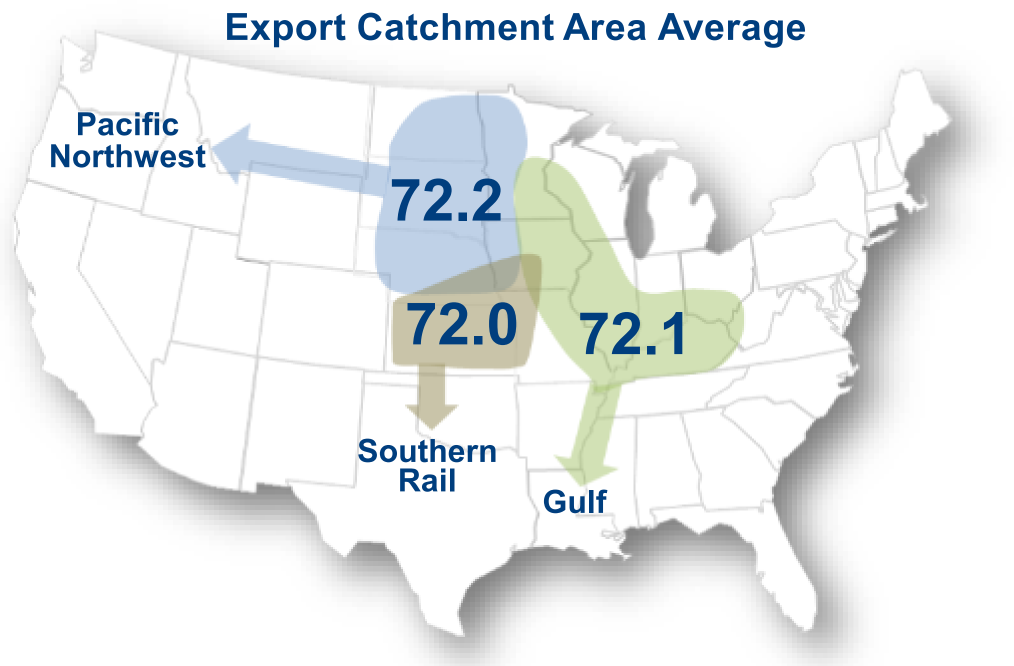
Starch (Dry Basis %)

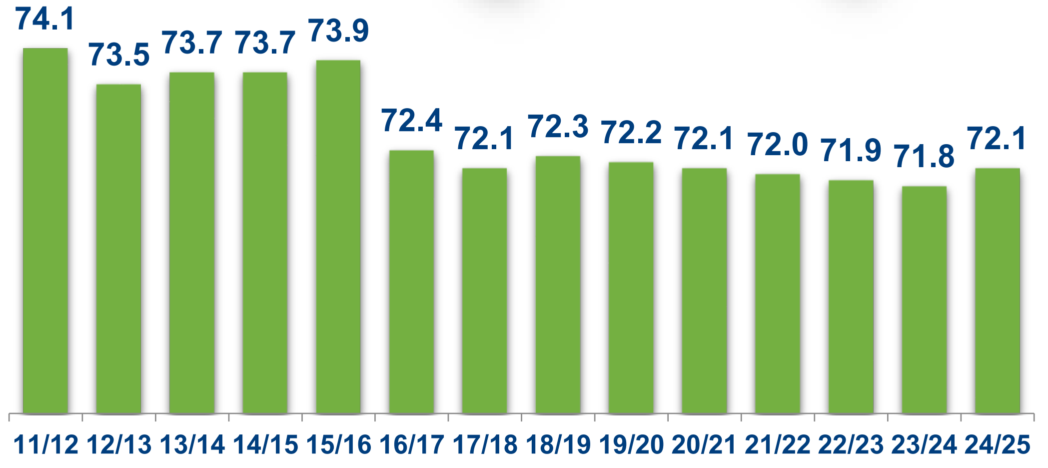
U.S. Aggregate: 72.1%

- Average **higher** than the 5YA (72.0%)
- The **Pacific Northwest** ECA had the highest starch for the first time in the report's history



Percent of Samples by Marketing Year



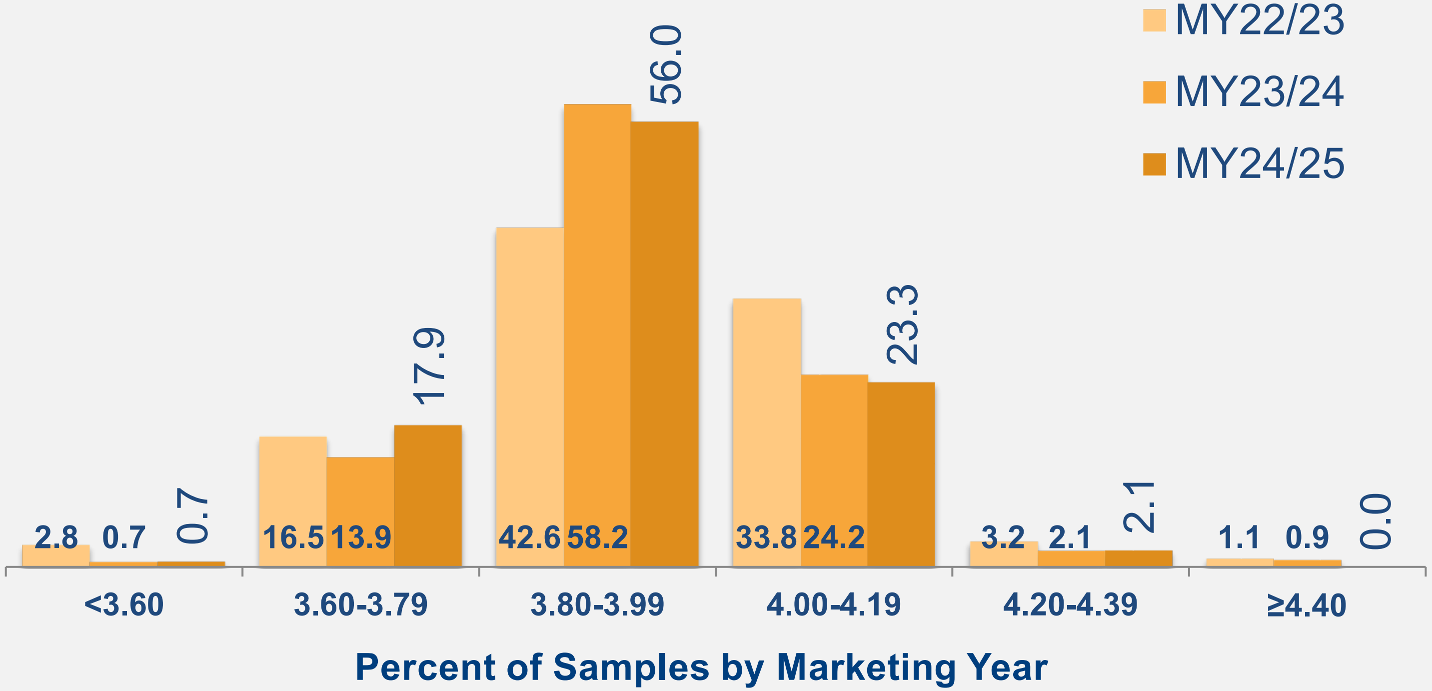


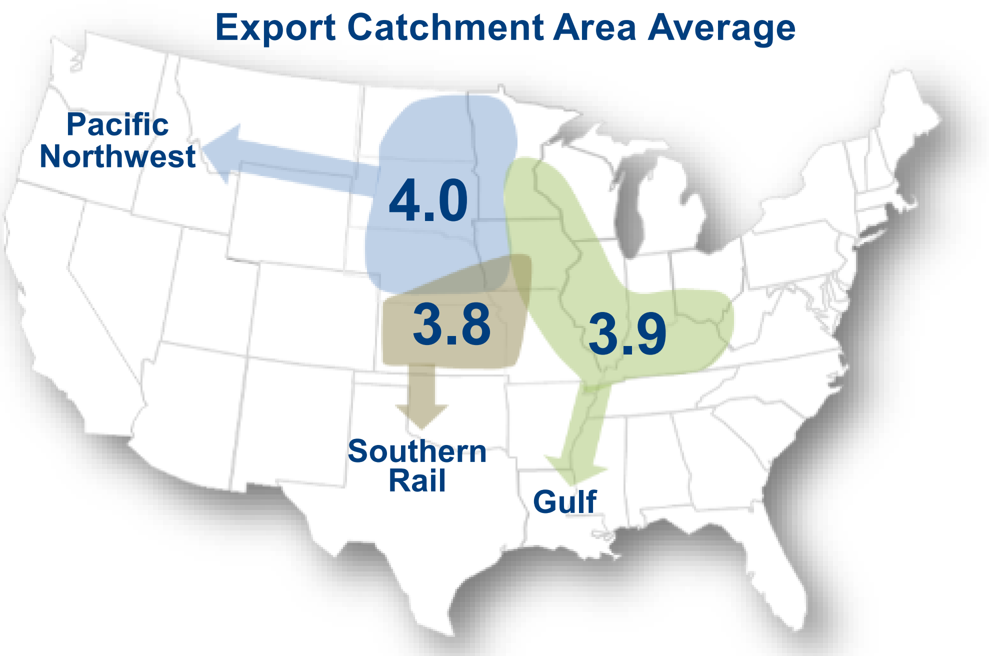
Historical Aggregate by Marketing Year

Oil (Dry Basis %)

U.S. Aggregate: 3.9%

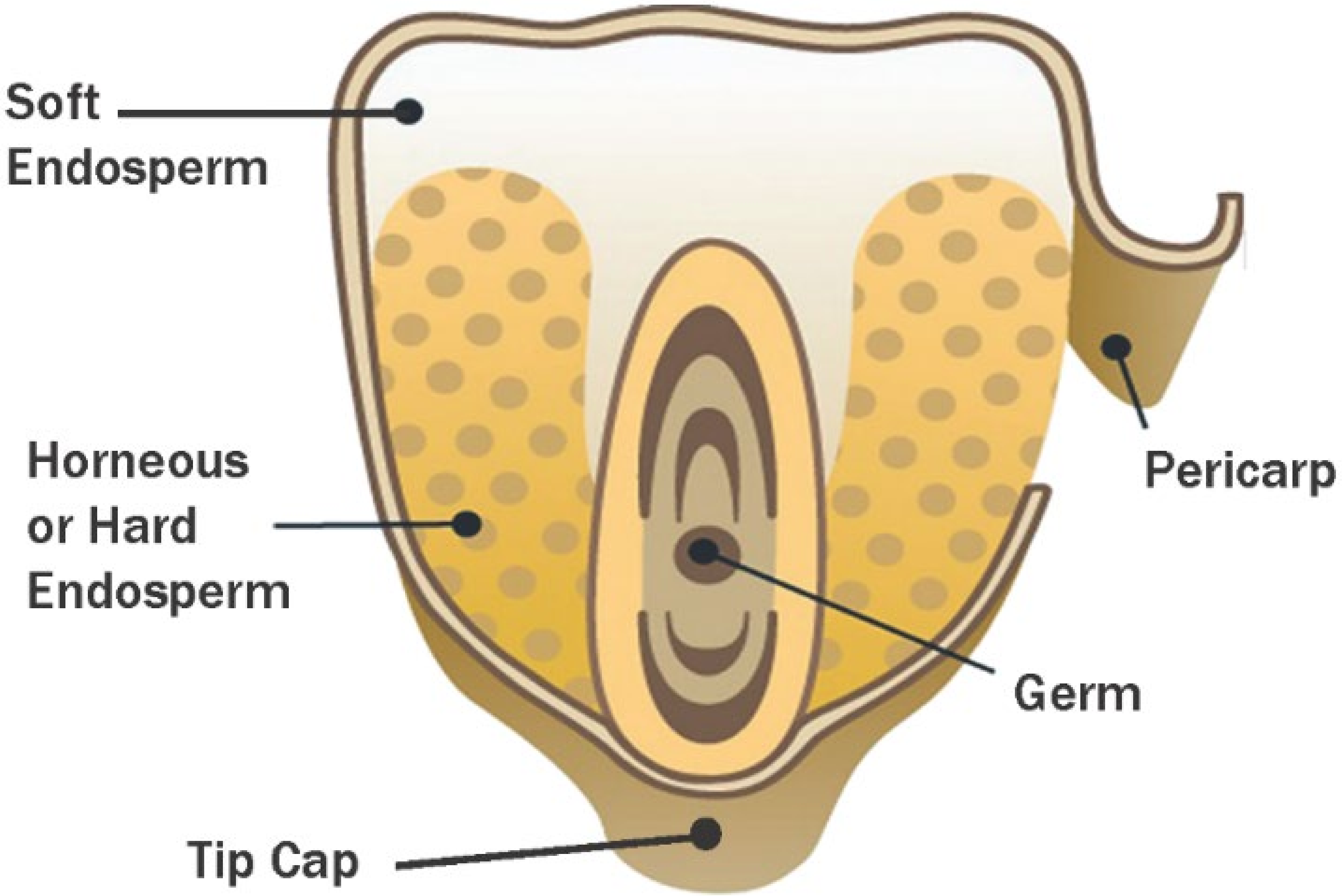
- ➢ Average **lower** than the 5YA (3.9%)





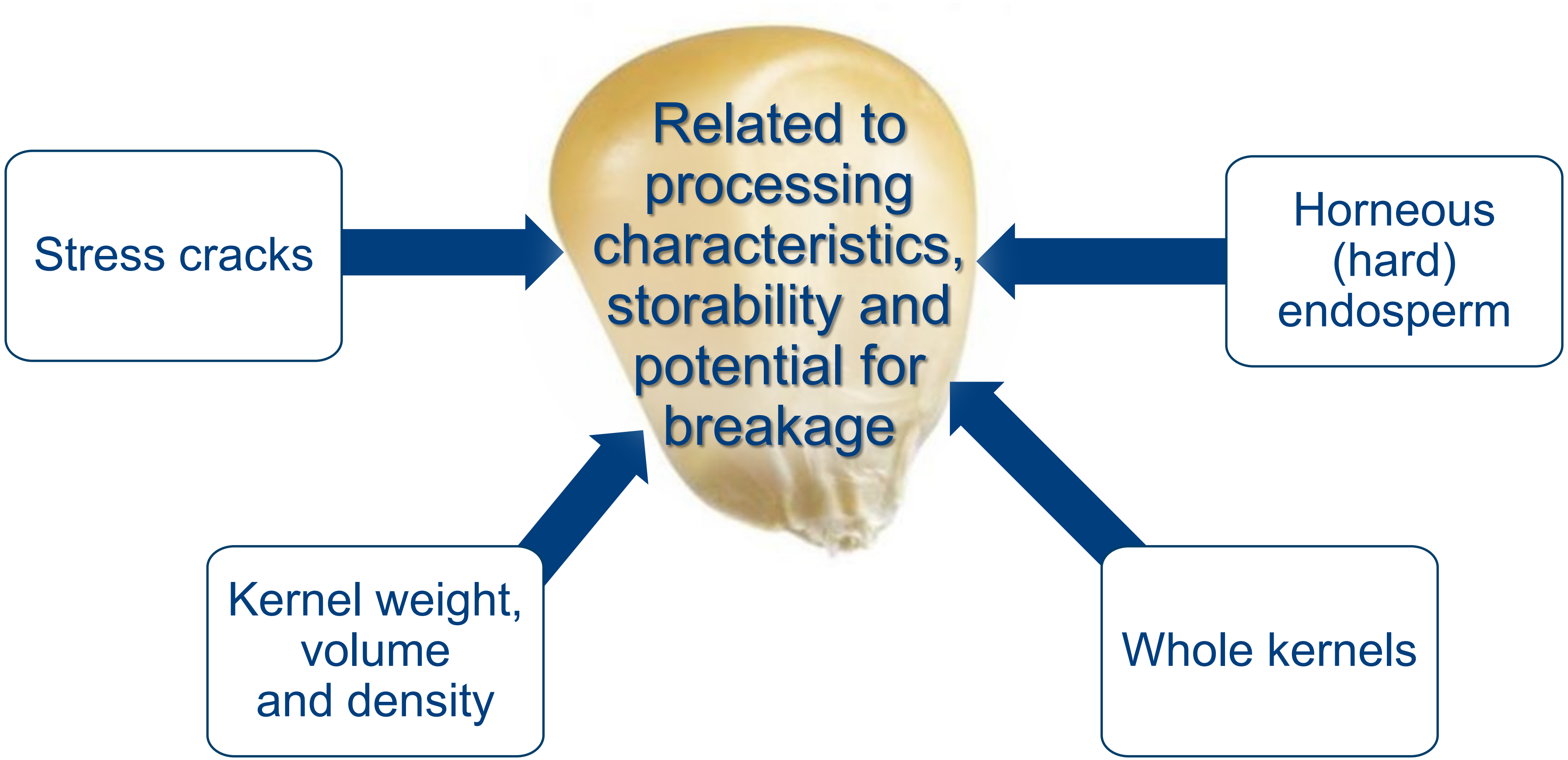
Physical Factors

Corn Morphology



Source: Adapted from Corn Refiners Association, 2011

Physical Factors – Overview



Physical Factors

	Number of Samples	Average	Standard Deviation	Minimum	Maximum
Stress Cracks (%)	425	11.6	7.0	0	51
100-Kernel Weight (g)	180	36.95	1.38	31.38	42.24
Kernel Volume (cm^3)	180	0.29	0.01	0.25	0.33
True Density (g/cm^3)	180	1.293	0.009	1.248	1.320
Whole Kernels (%)	425	89.1	4.4	67.8	97.8
Horneous Endosperm (%)	180	87	2	81	92

Stress Cracks

Internal cracks in the horneous (hard) endosperm

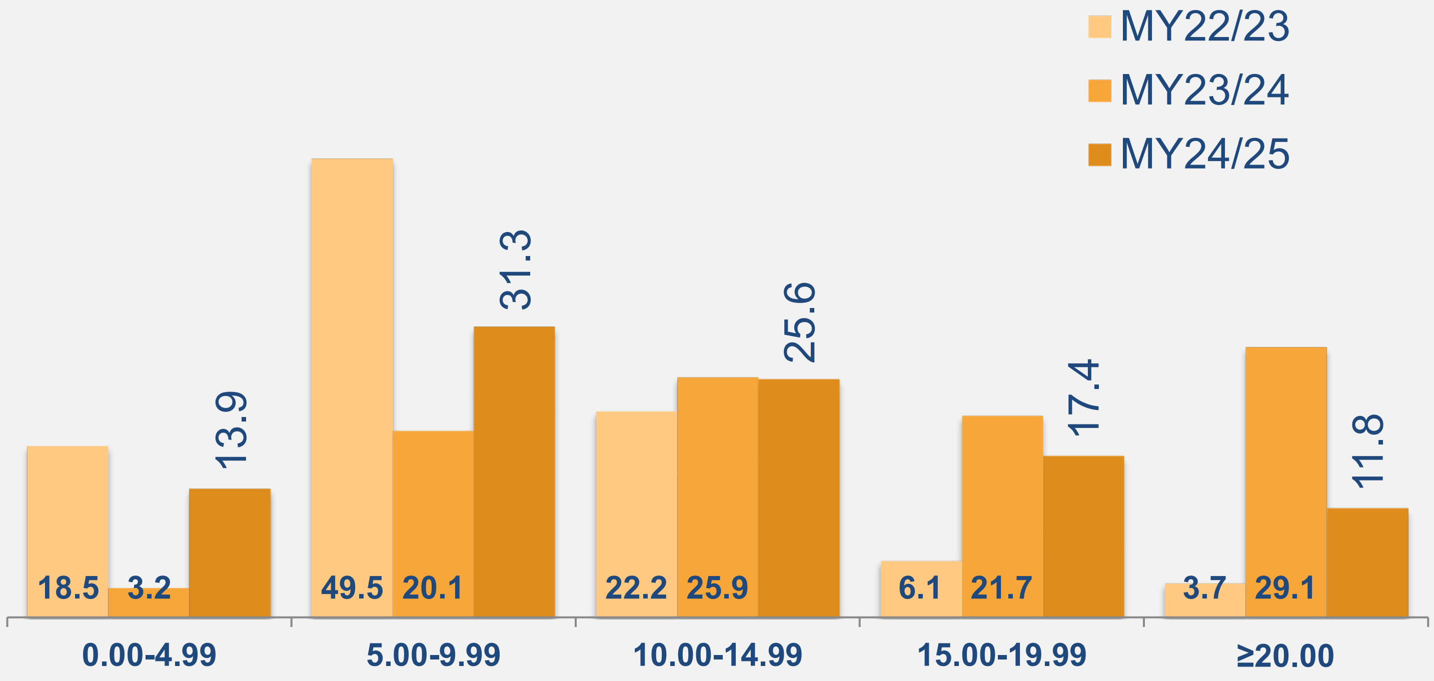
Most common cause is artificial drying

Impacts breakage susceptibility, milling and alkaline cooking

Stress Cracks (%)

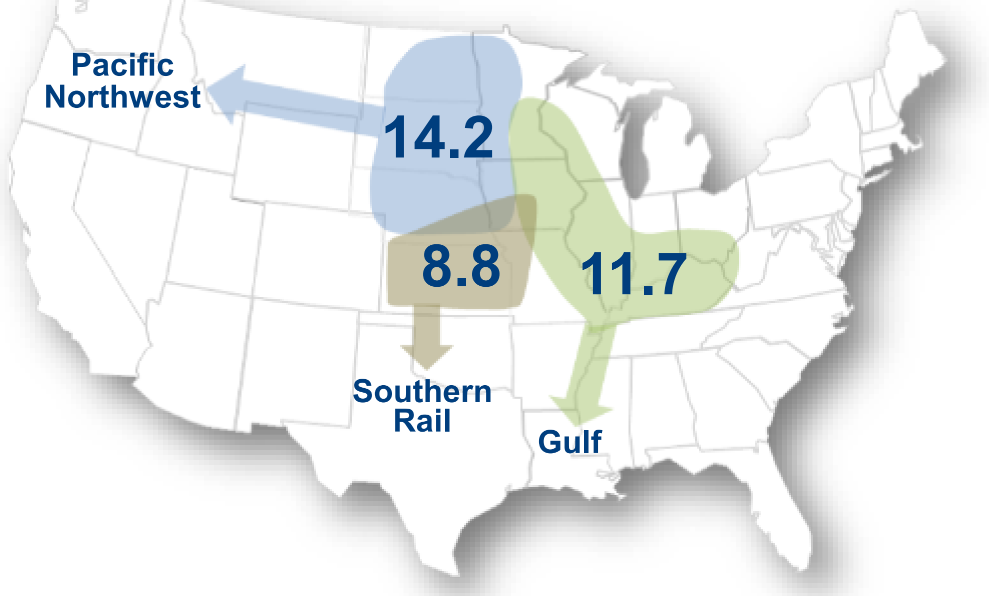
U.S. Aggregate: 11.6%

- Average **similar** to the 5YA (11.0%)
- Breakage susceptibility similar to the average of five previous years



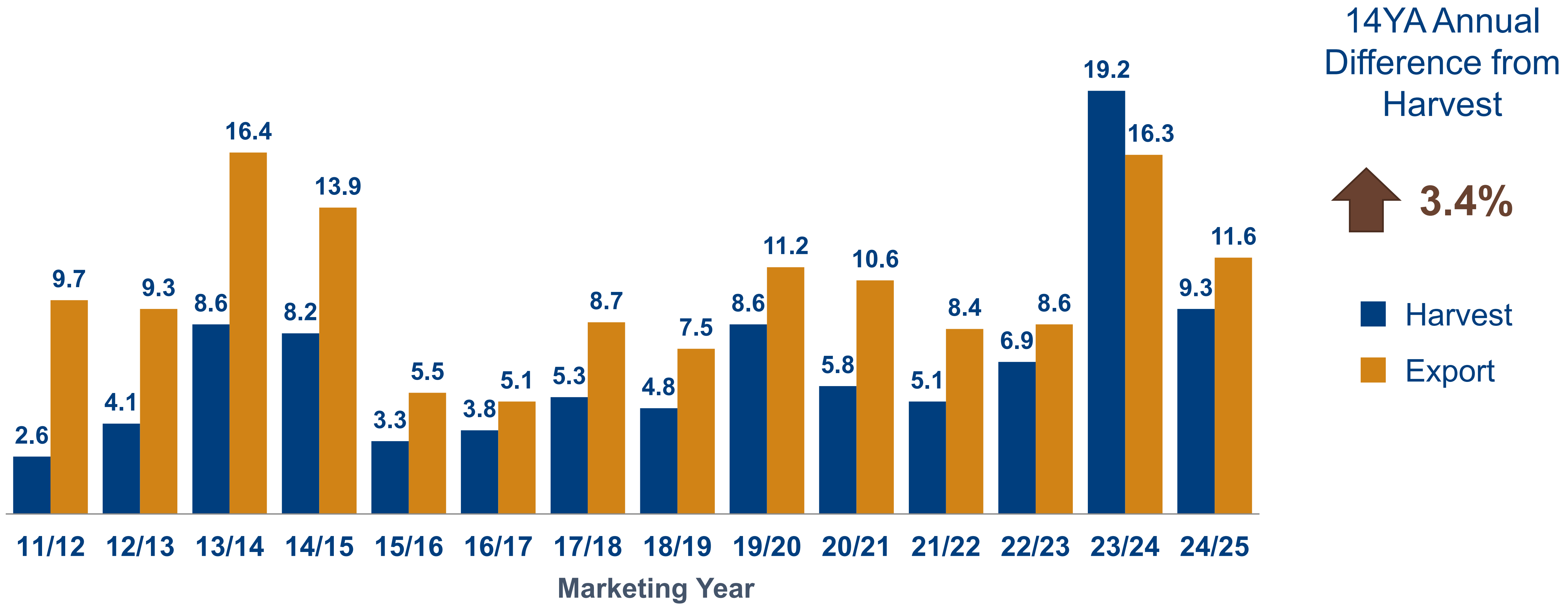
Percent of Samples by Marketing Year

Export Catchment Area Average



Historical Aggregate by Marketing Year

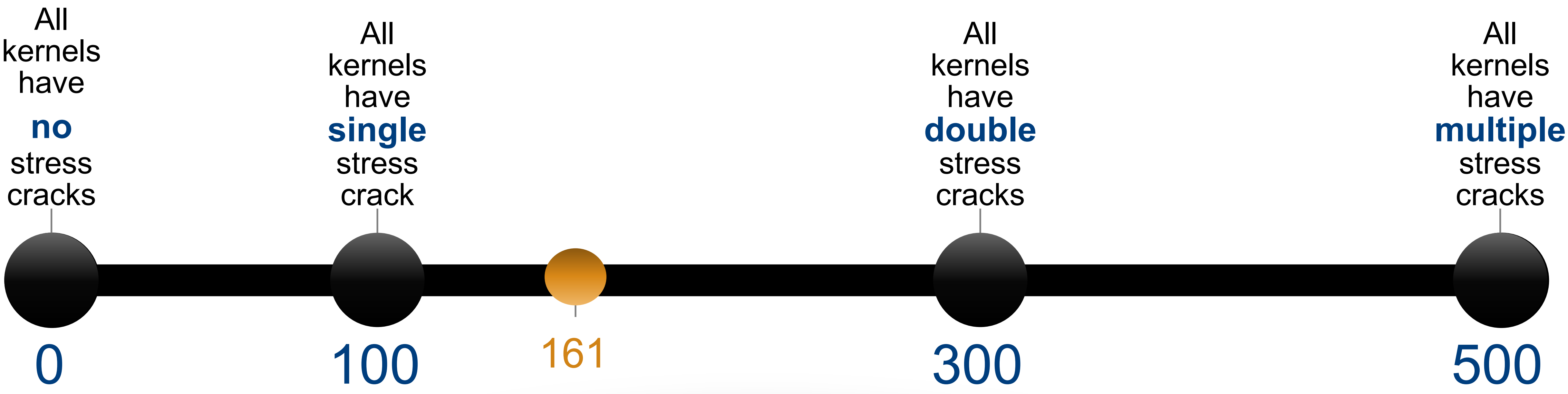
Harvest vs. Export Cargo Stress Cracks (%)



Stress Crack Index

[% kernels with 1 stress crack × 1] + [% kernels with 2 stress cracks × 3] + [% kernels with > 2 stress cracks × 5] = SCI

Magnitude of Stress Crack Index



Example:

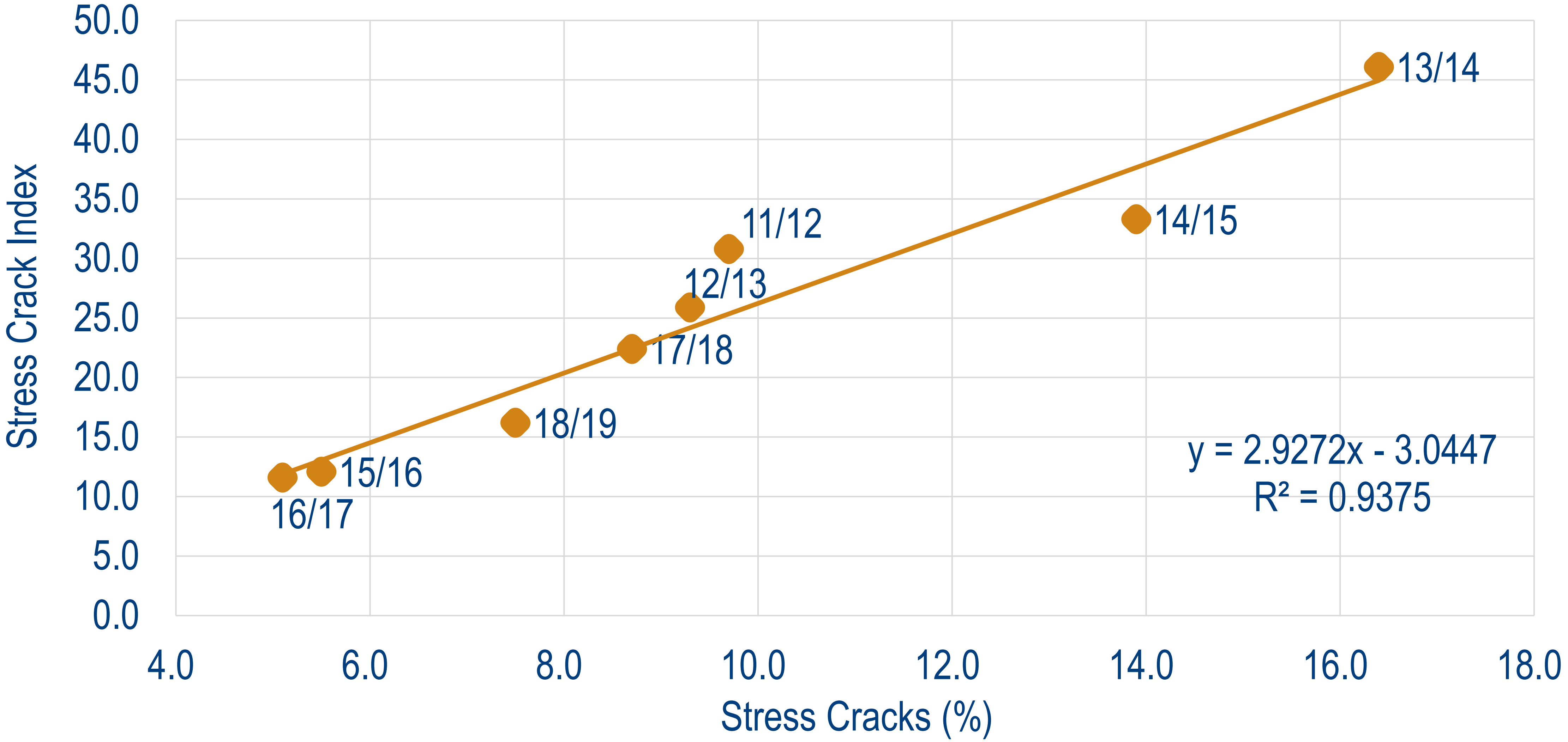
SC% = 43%

SCI Calculation

$$(4\%^{a} \times 1) + (19\%^{b} \times 3) + (20\%^{c} \times 5) = 161$$

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

Stress Cracks (%) vs. Stress Crack Index



Kernel Weight, Volume and Density

100-Kernel Weight (grams)	÷	Kernel Volume (cubic centimeters)	=	True Density (grams per cubic centimeters)

100-Kernel Weight (grams)

Indicates kernel size which affects

- Drying rates
- Flaking grit yields in dry milling

Kernel Volume (cubic centimeters)

Kernel volume is indicative of growing conditions and genetics

True Density (grams per cubic centimeters)

True density reflects kernel hardness

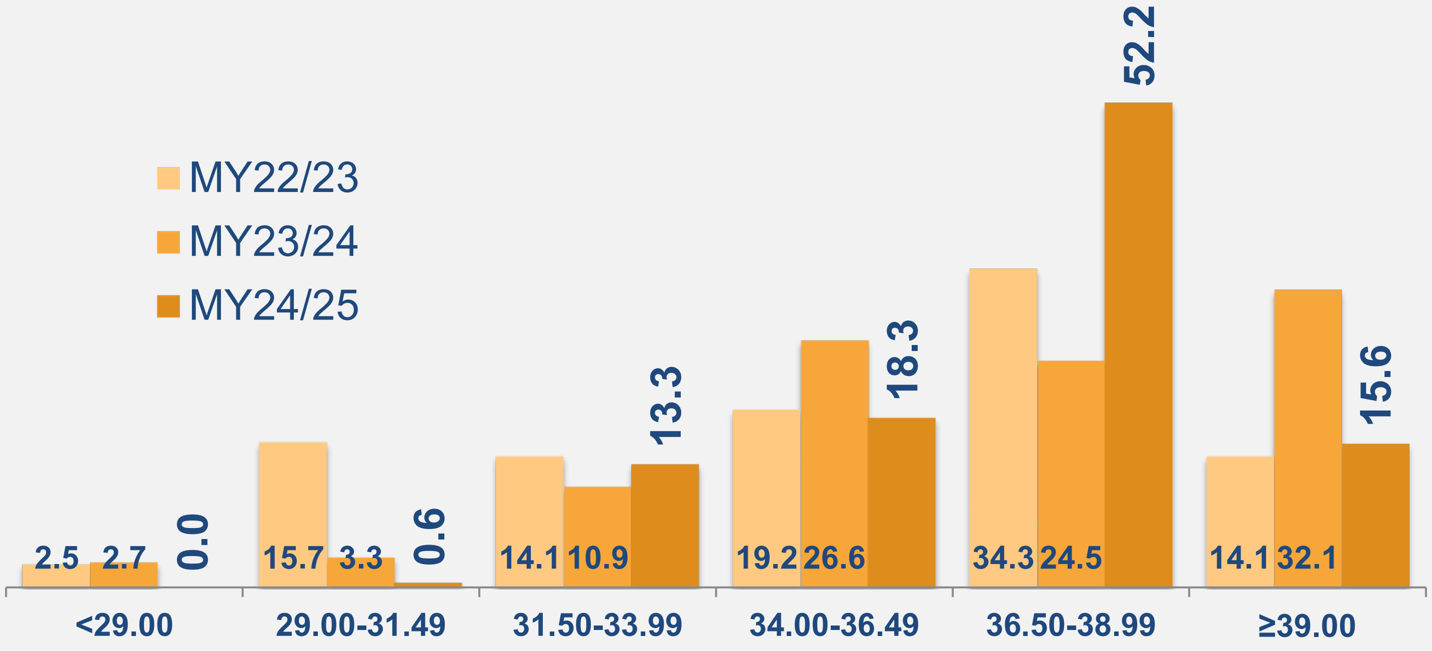
Higher density – harder kernels, less susceptible to breakage, more desirable for dry milling and alkaline processing

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

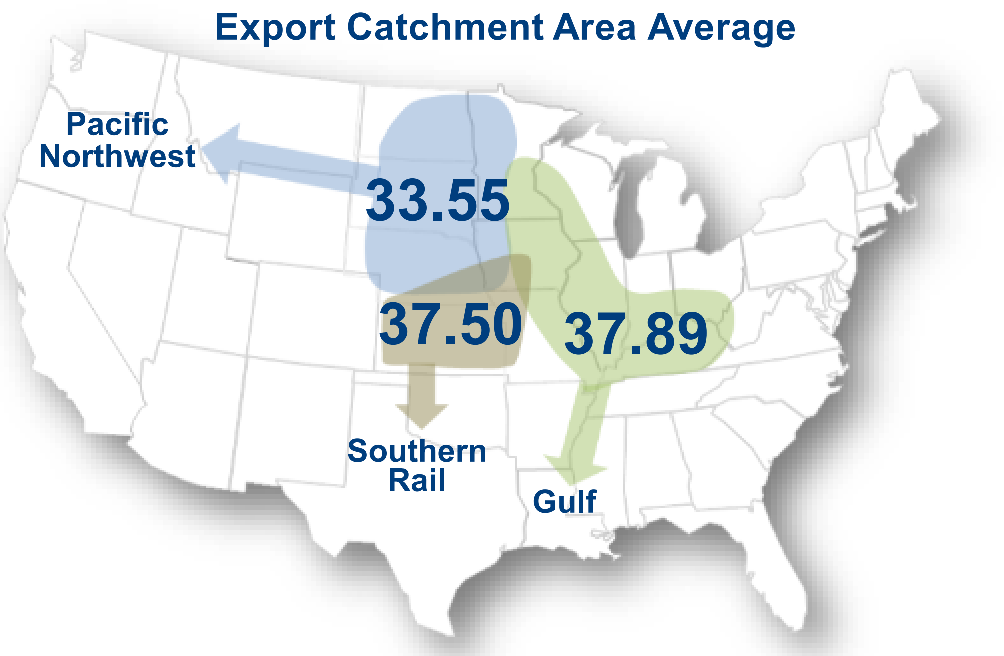
100-Kernel Weight (grams)

U.S. Aggregate: 36.95 grams

- ➢ Average **higher** than the 5YA (36.17 g)



Percent of Samples by Marketing Year

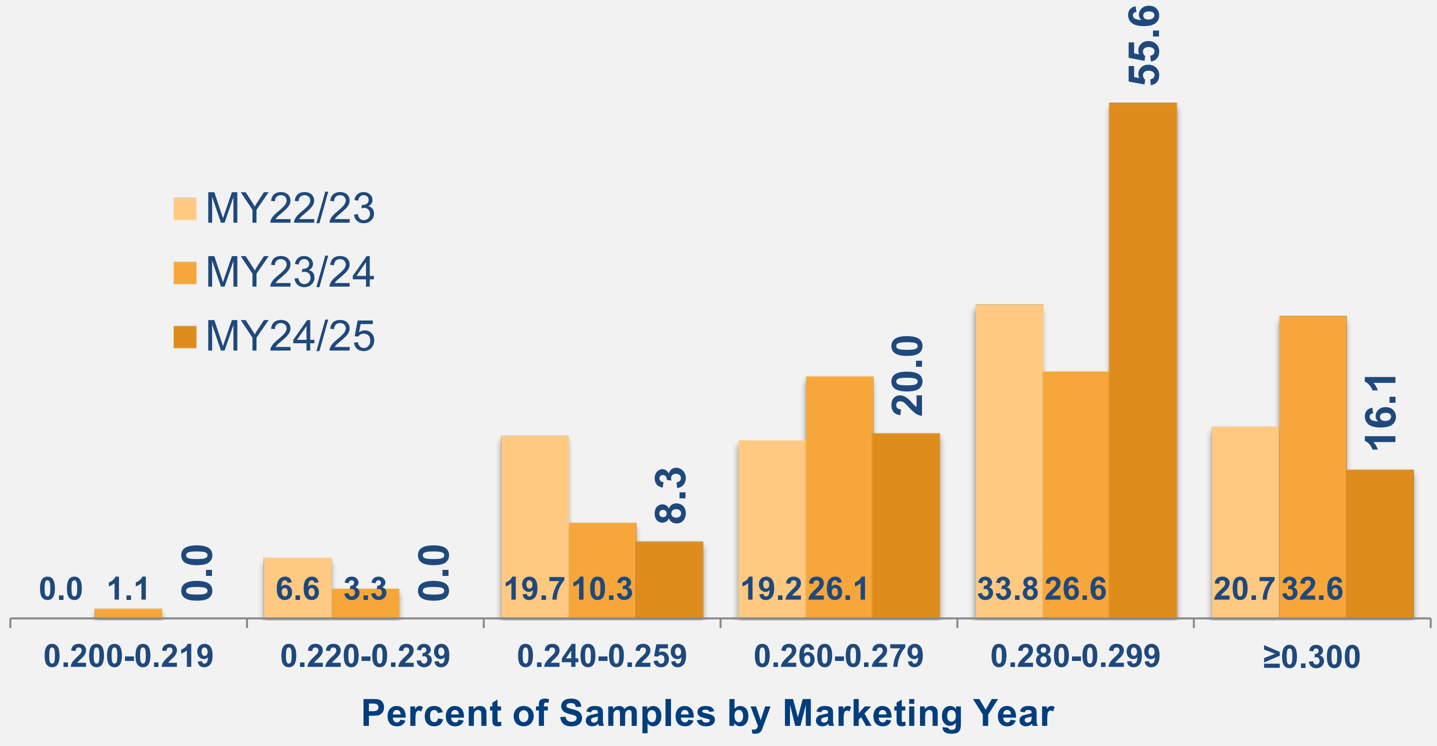


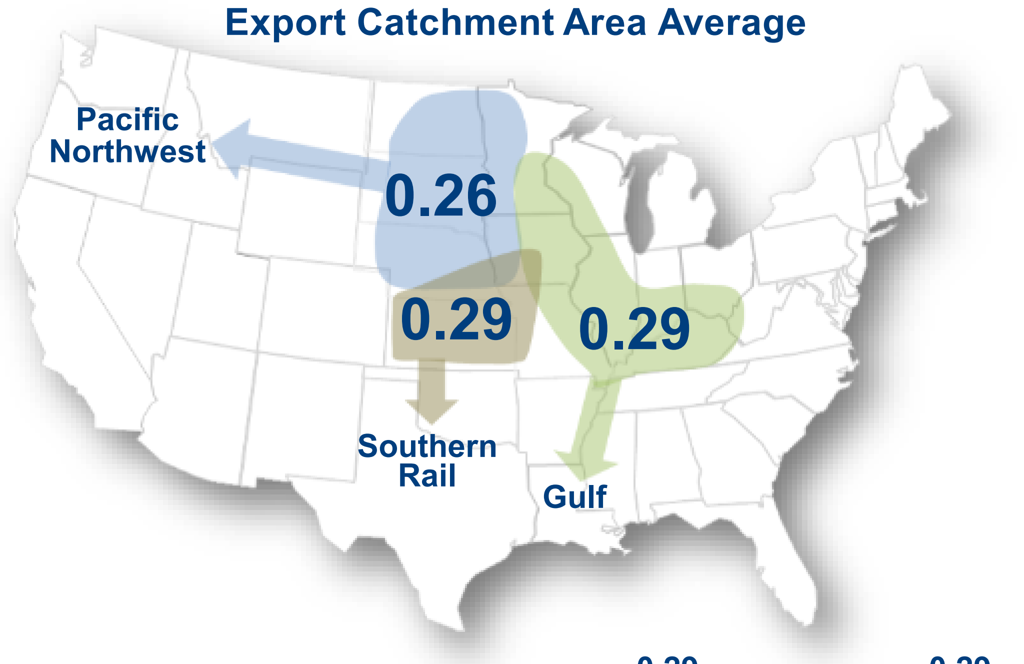
Historical Aggregate by Marketing Year

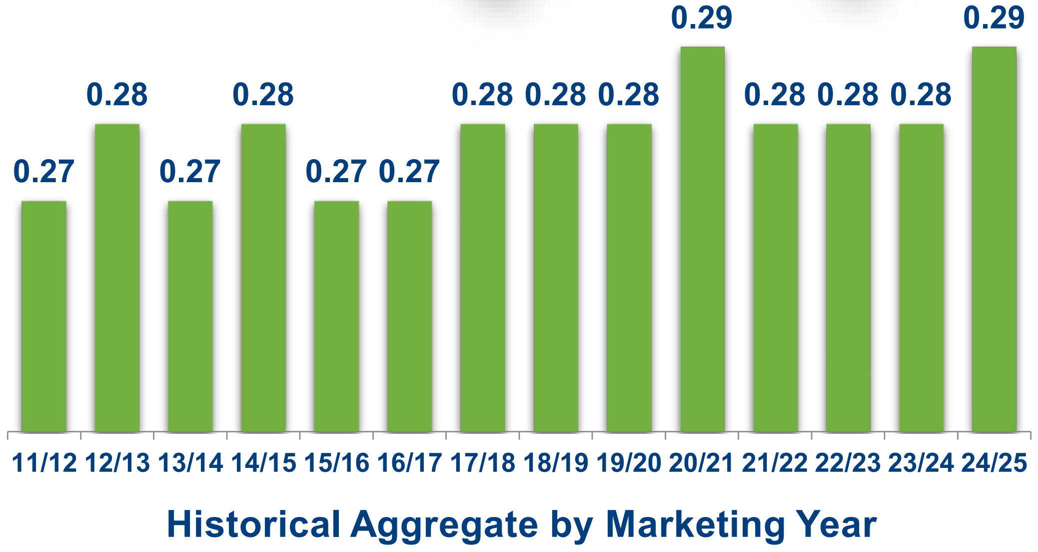
Kernel Volume (cm^3)

U.S. Aggregate: 0.29 cm^3

- Average **higher** than the 5YA (0.28 cm^3)



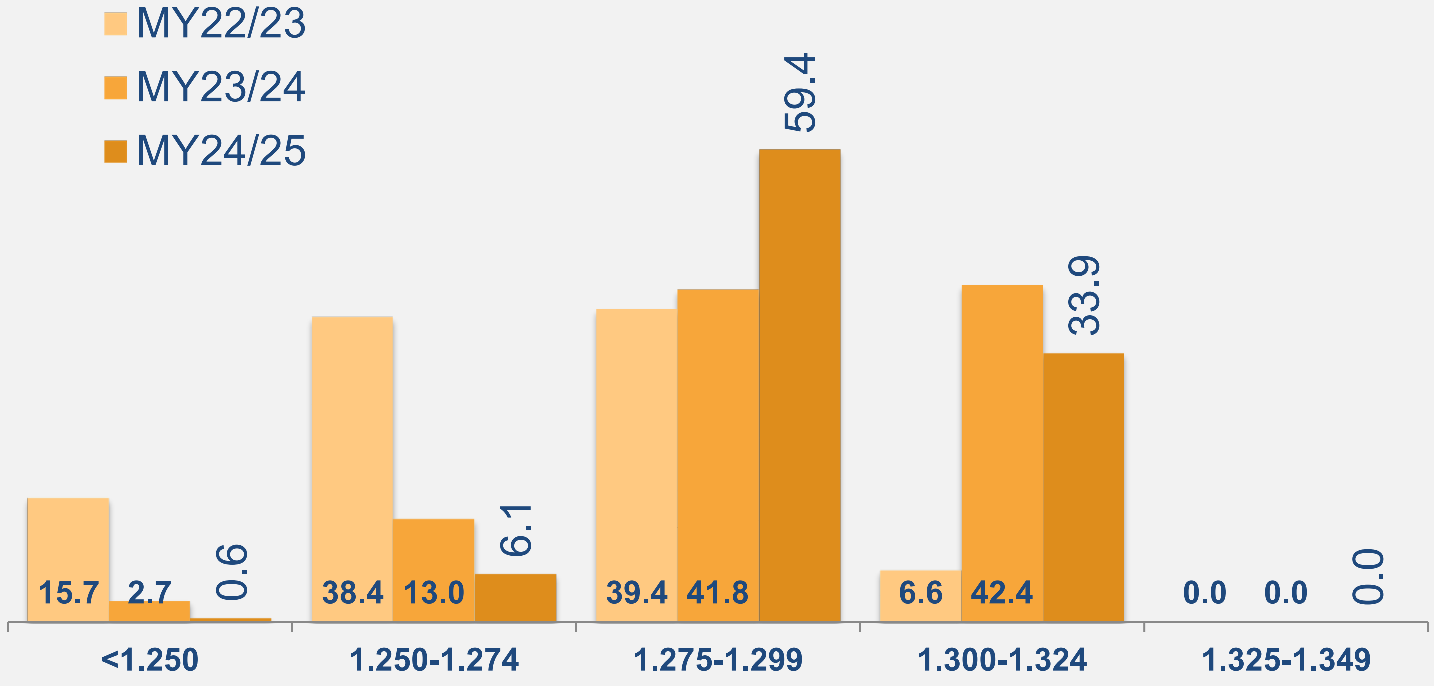




Kernel True Density (g/cm^3)

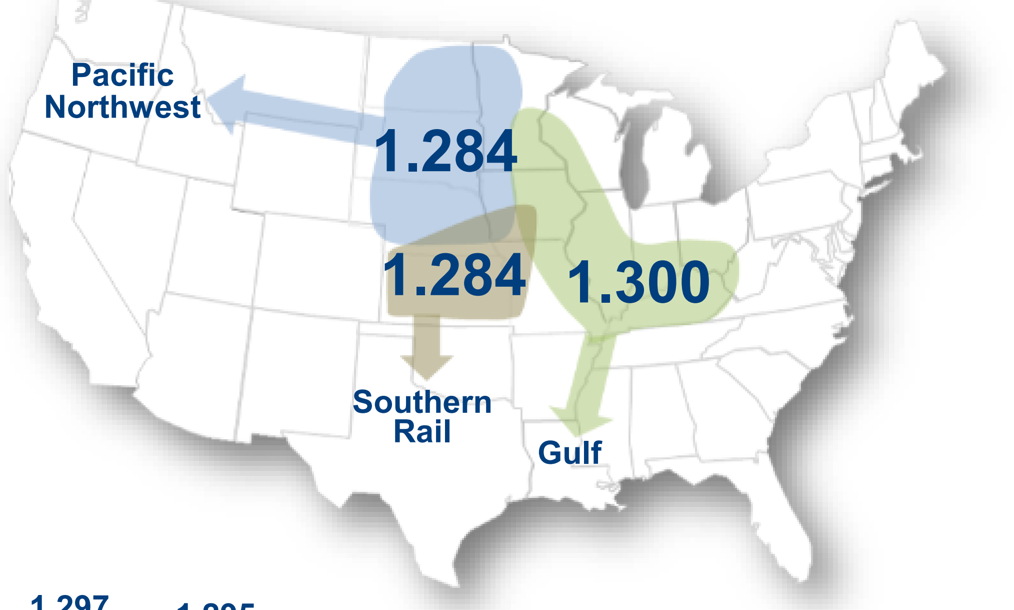
U.S. Aggregate: 1.293 g/cm^3

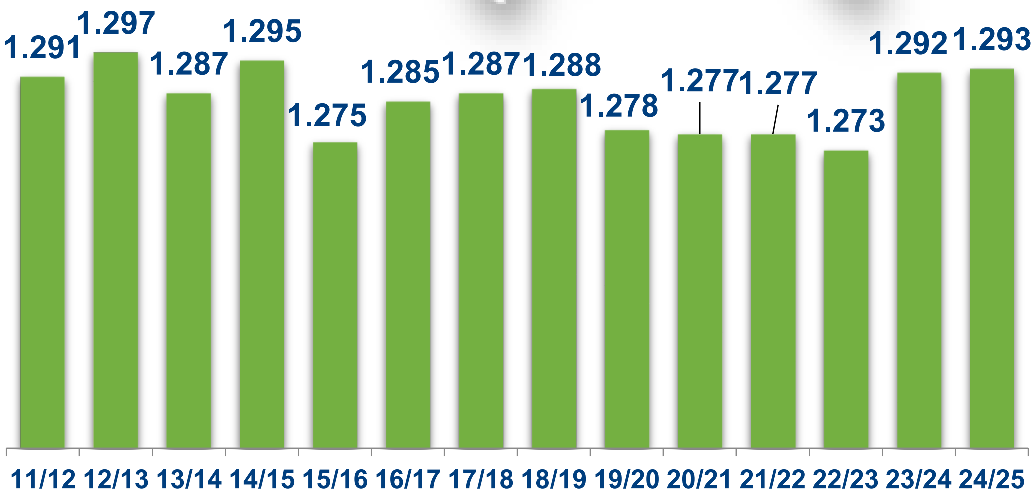
- Average **higher** than the 5YA (1.279 g/cm^3)



Percent of Samples by Marketing Year

Export Catchment Area Average



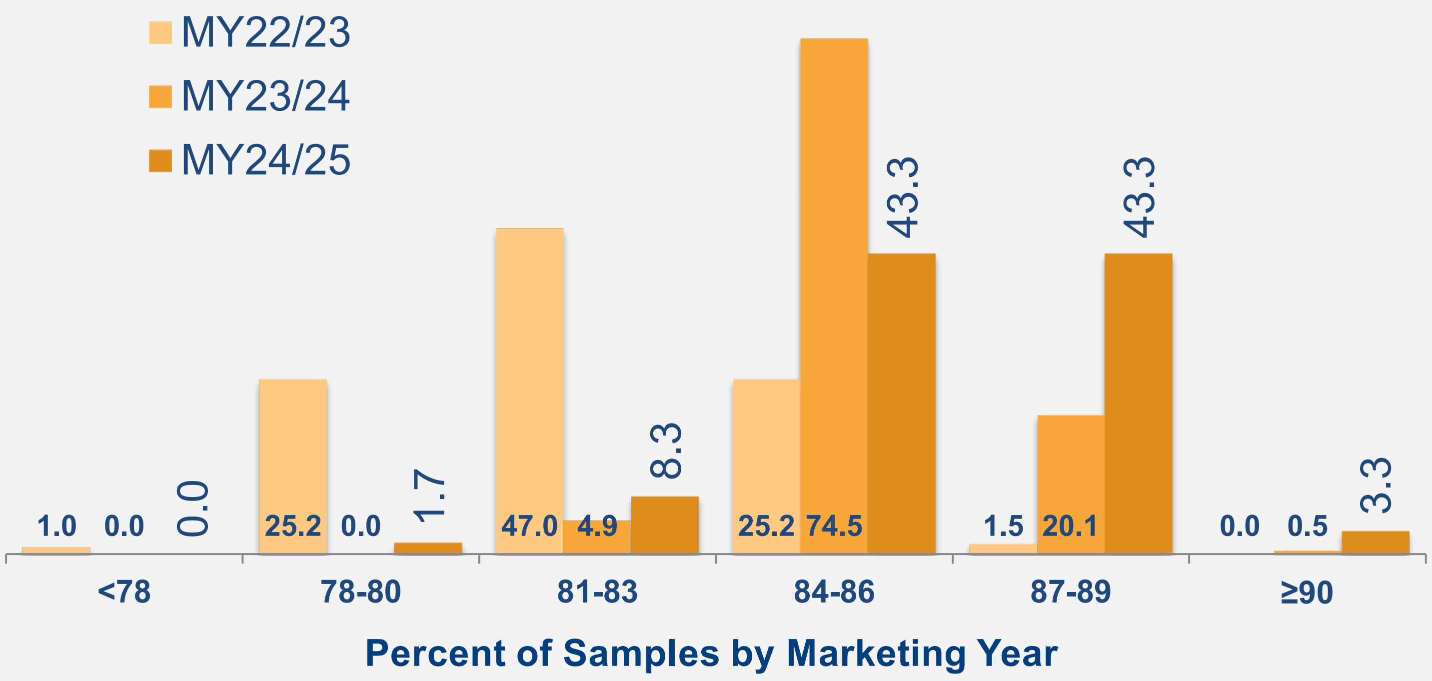


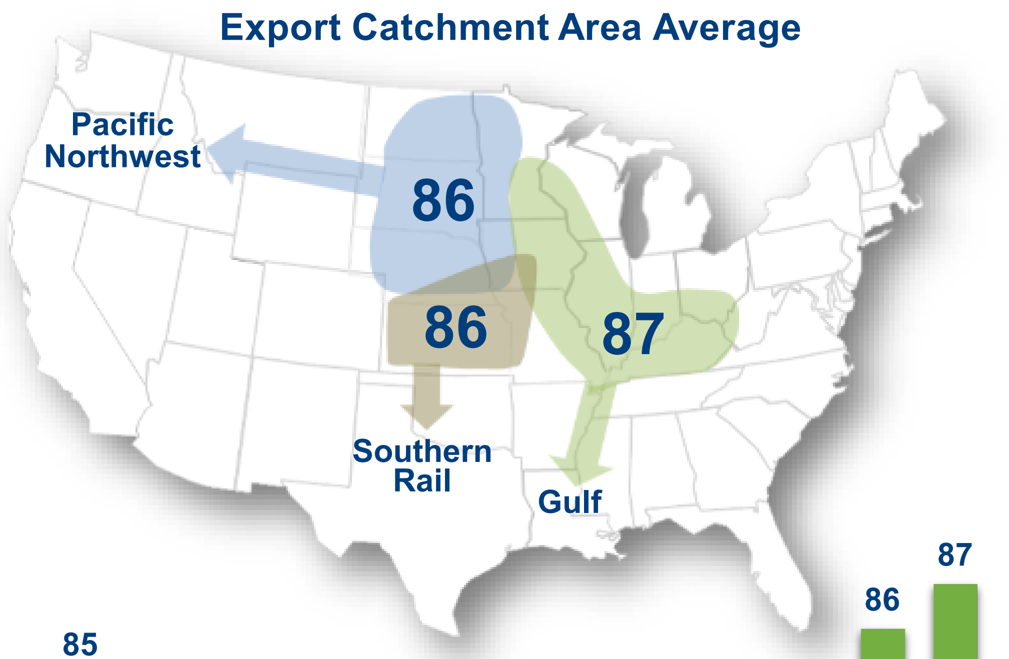
Historical Aggregate by Marketing Year

Horneous (Hard) Endosperm (%)

U.S. Aggregate: 87%

- ➢ Average **higher** than the 5YA (83%)





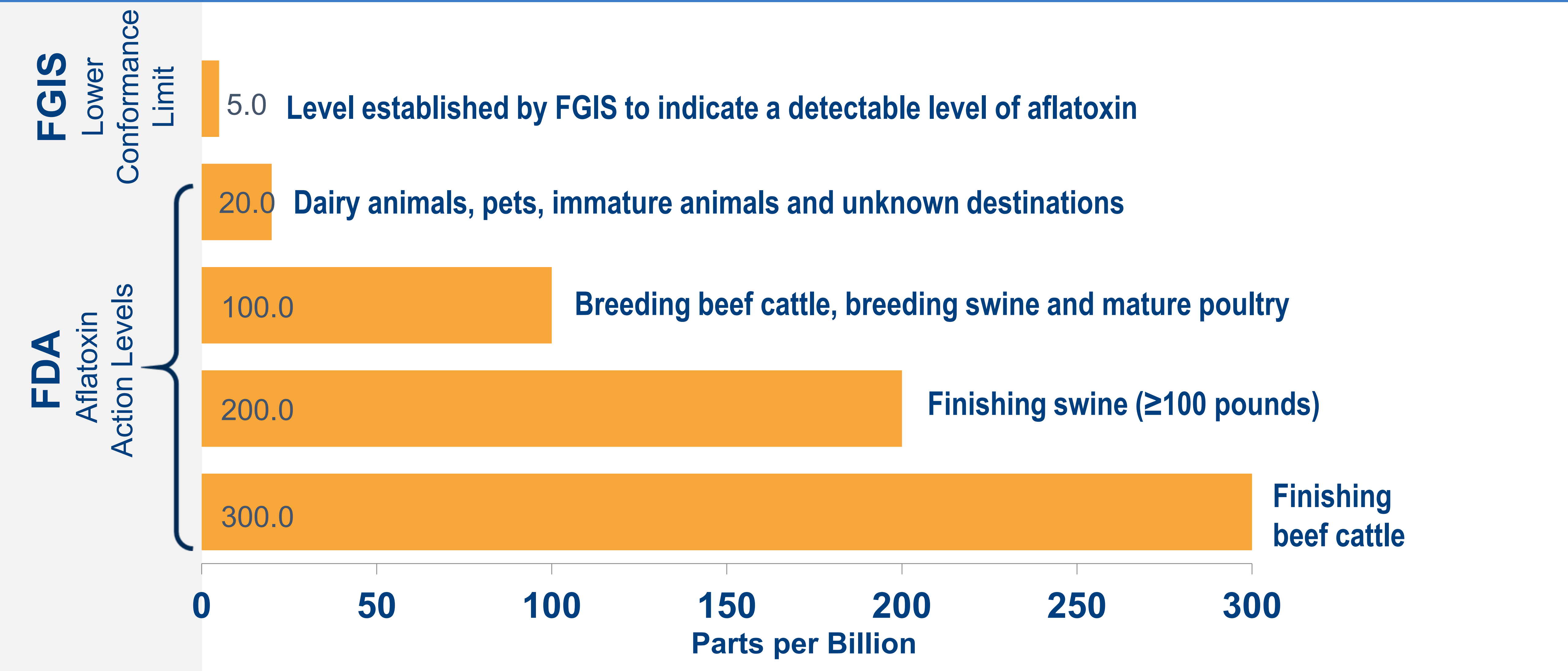
Mycotoxins

Aflatoxin,
Deoxynivalenol (DON or Vomitoxin)
Fumonisin
Ochratoxin A
Trichothecenes (T-2)
and Zearalenone

Export Cargo Mycotoxin Testing

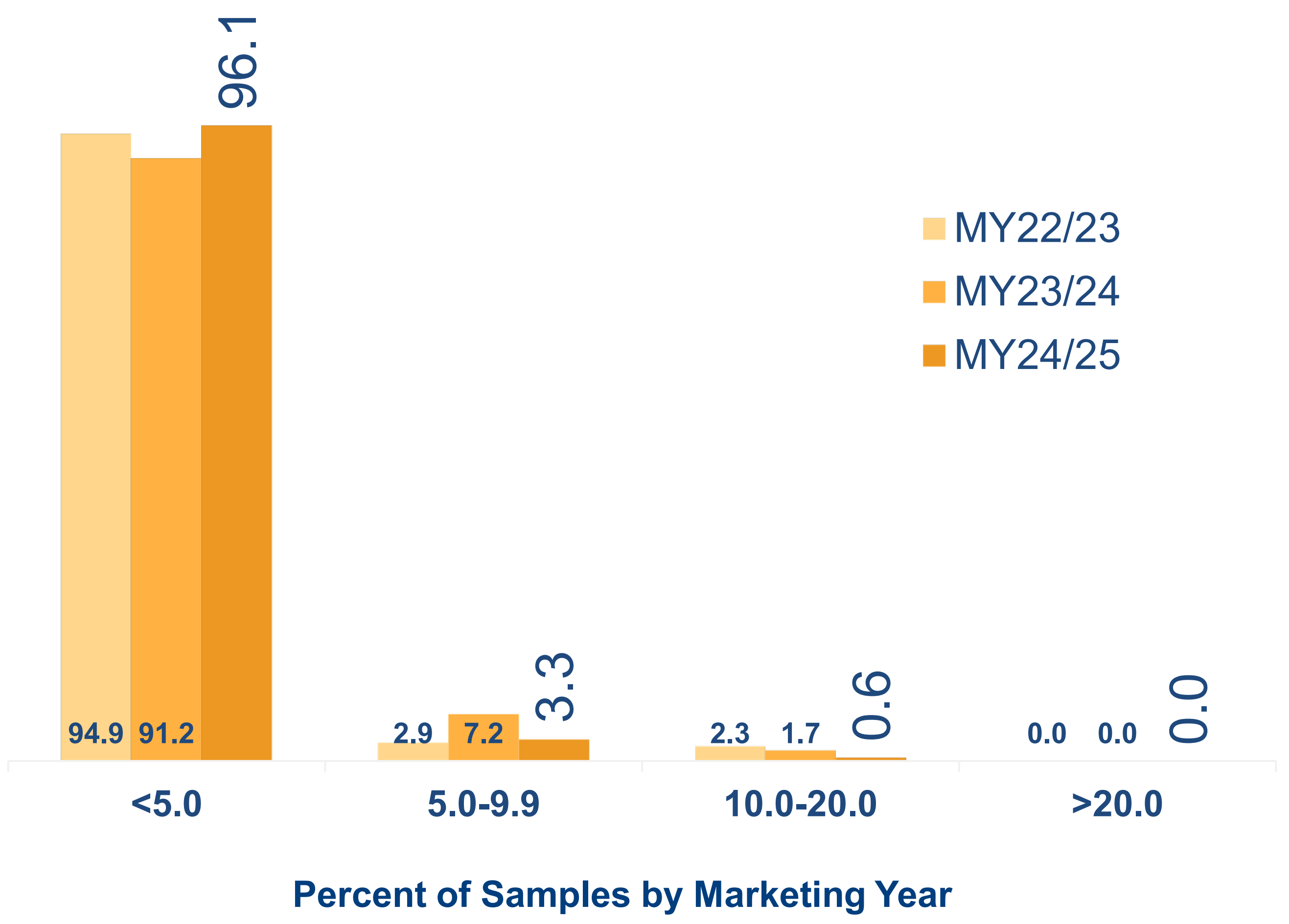
- Provides an assessment of the presence of **aflatoxin, DON, fumonisin, ochratoxin A**, **trichothecenes (T-2)** and **zearalenone** in U.S. corn as it reaches export points early in the marketing year
- **180** export cargo samples tested for mycotoxins
- Reports **ONLY** the frequency of detected elevated levels of the mycotoxins in export samples

Key Aflatoxin Levels (ppb)

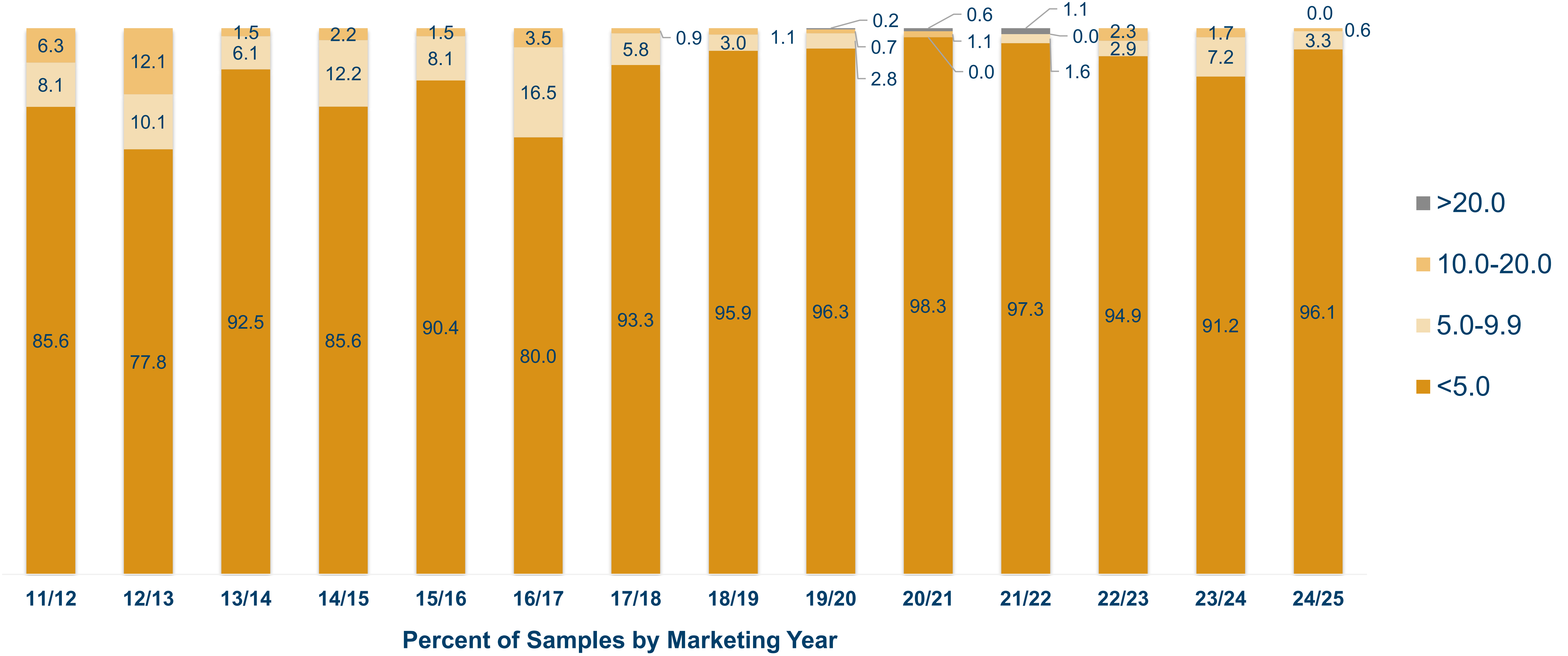


Aflatoxin Testing Results (ppb)

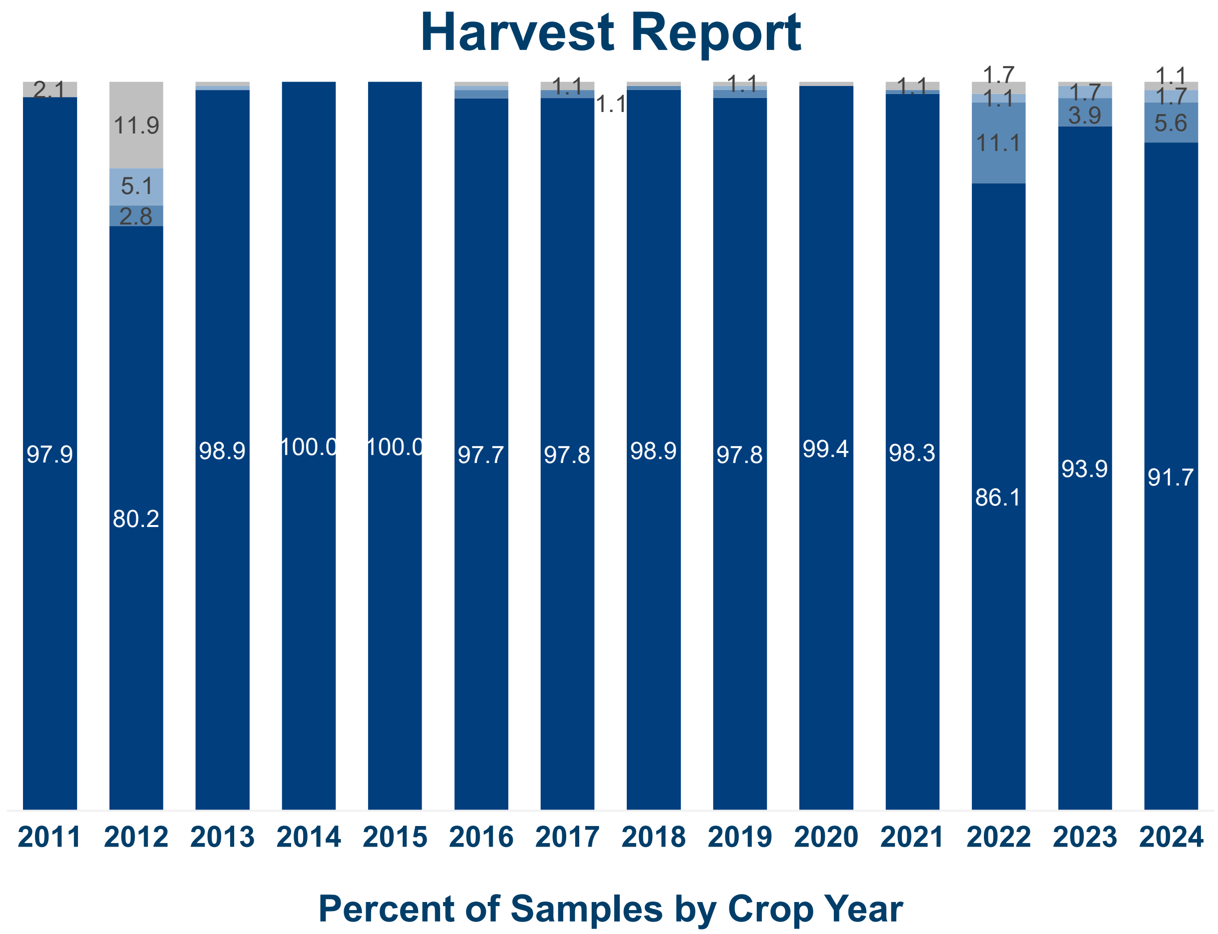
- All samples tested **below** the FDA action level of 20 ppb
- A **higher** proportion of the export samples had **no detectable** levels of aflatoxin (<5.0 ppb) in 2024/2025 compared to the two previous years

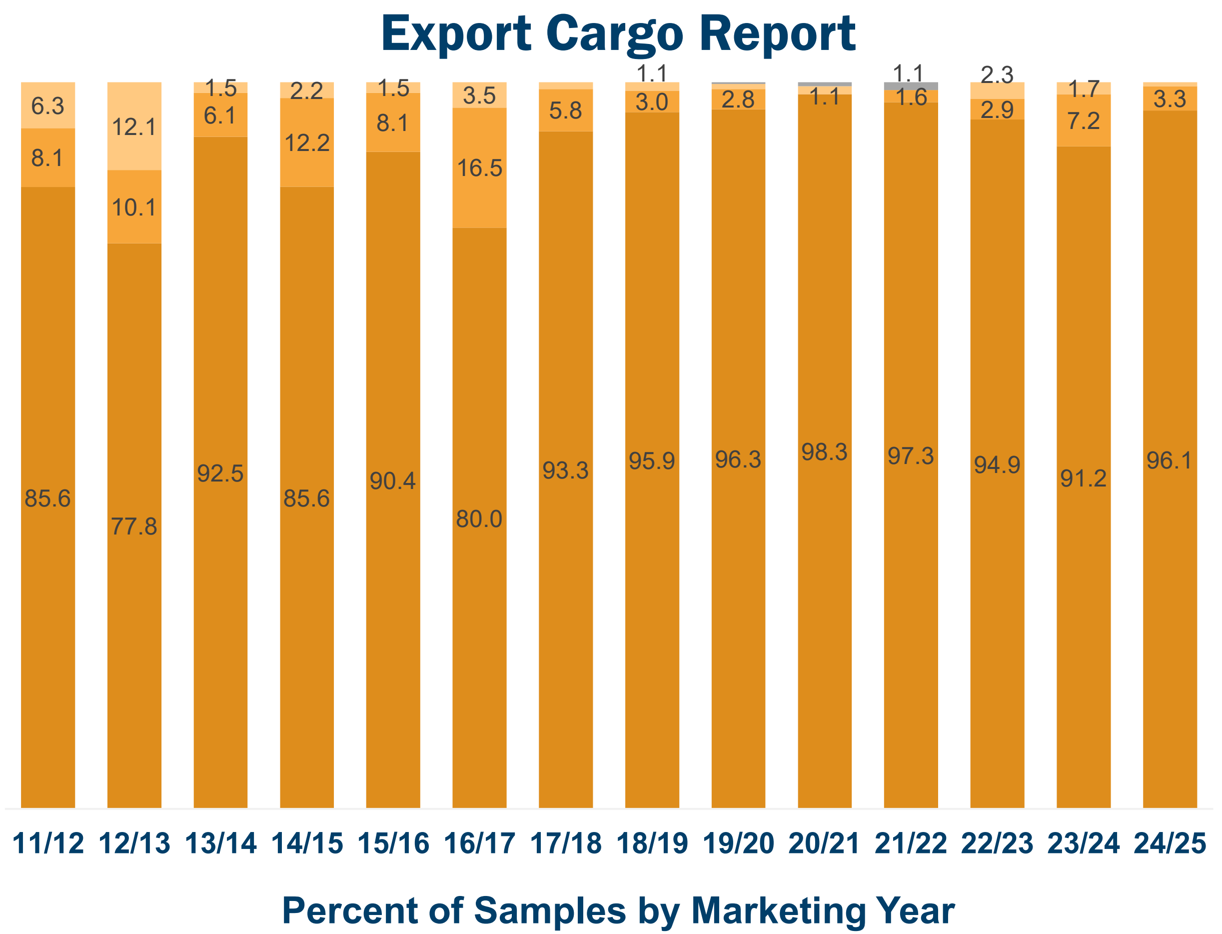


Historical Aflatoxin Results



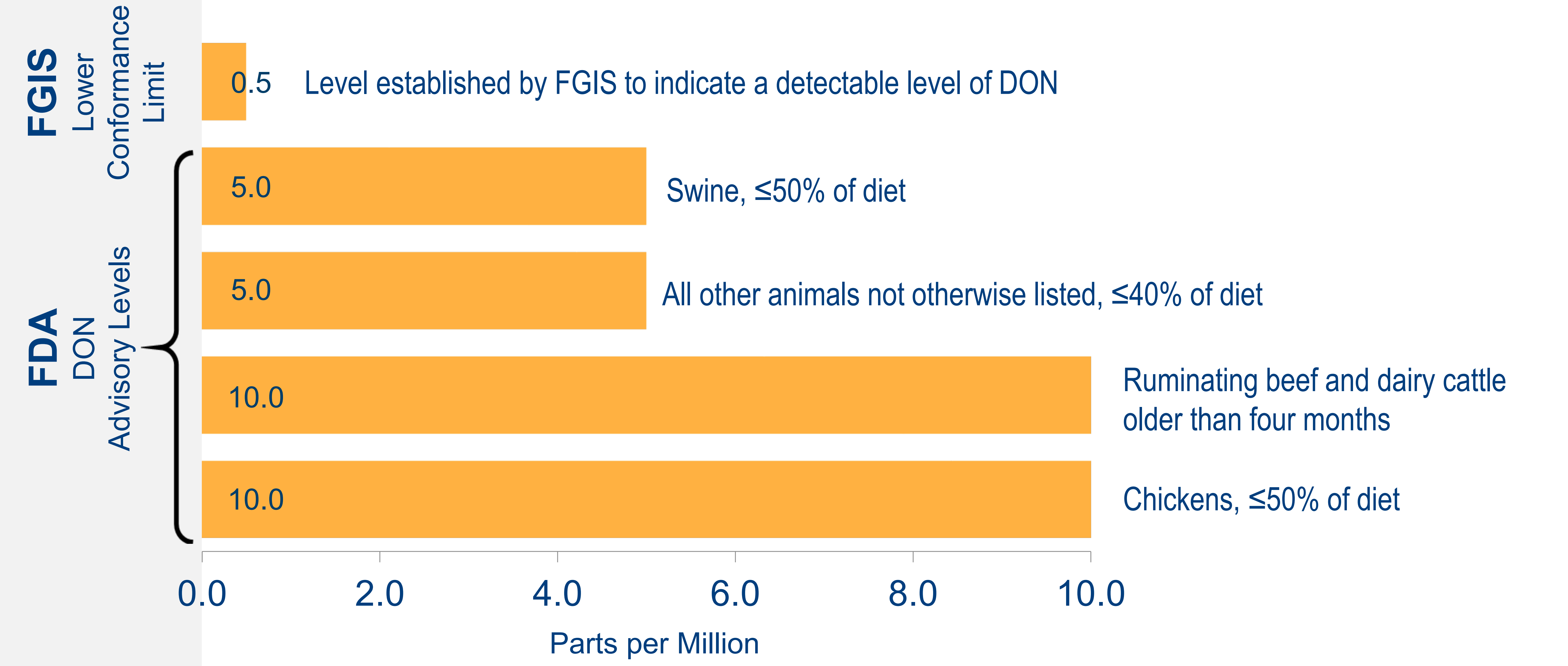
Harvest vs. Export Cargo Historical Aflatoxin Results (ppb)





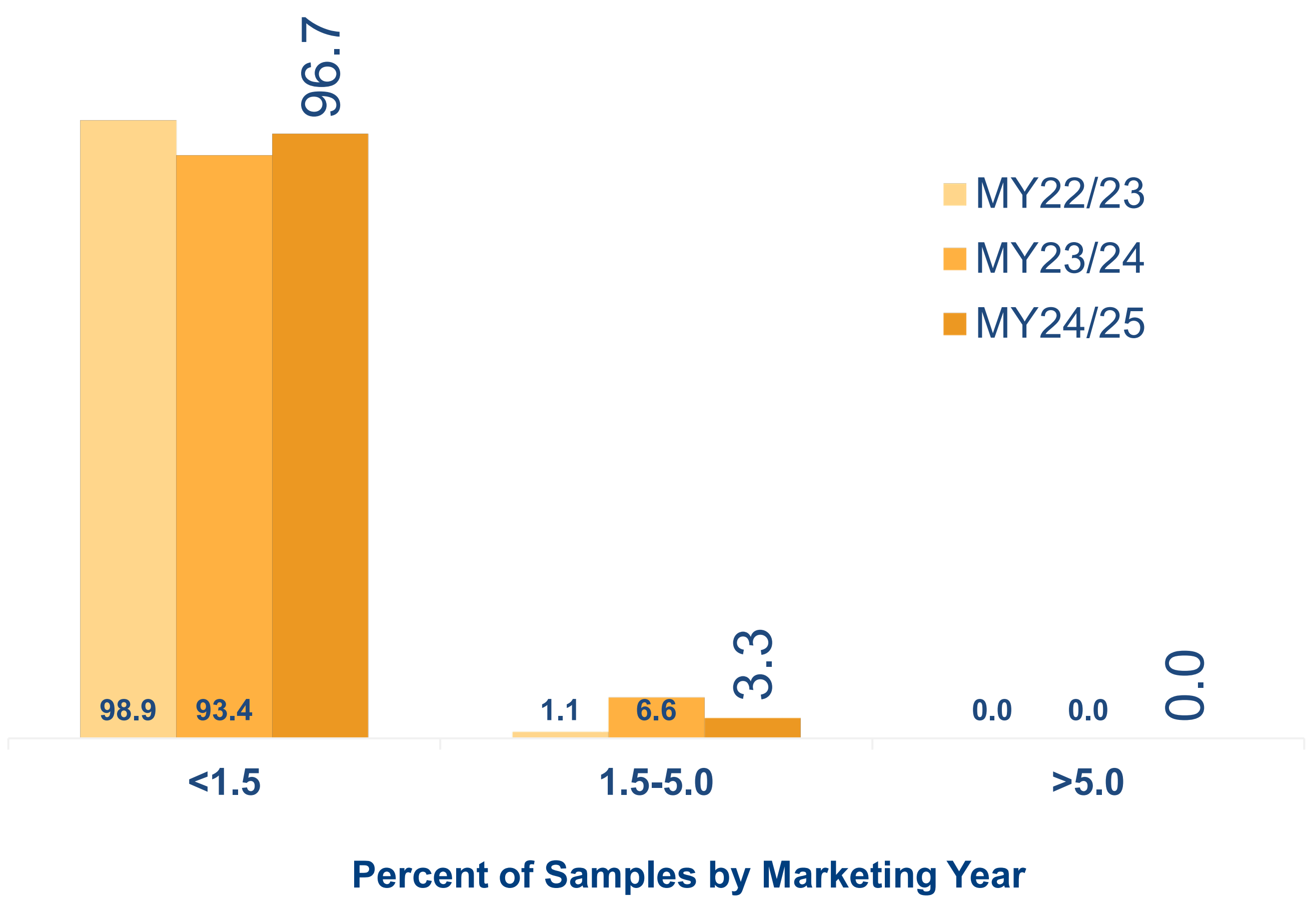
<5.0 5.0-9.9 10.0-20.0 >20.0

Key DON Levels (ppm)

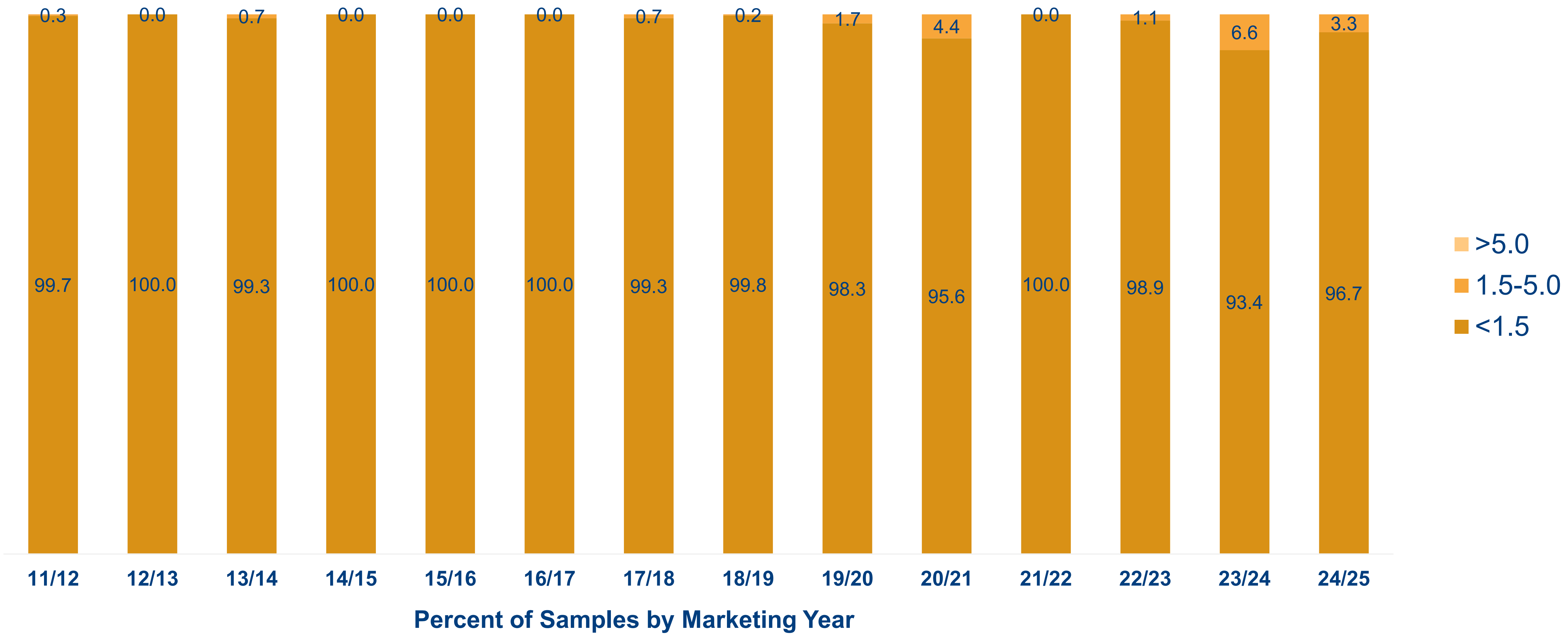


DON (Vomitoxin) Testing Results (ppm)

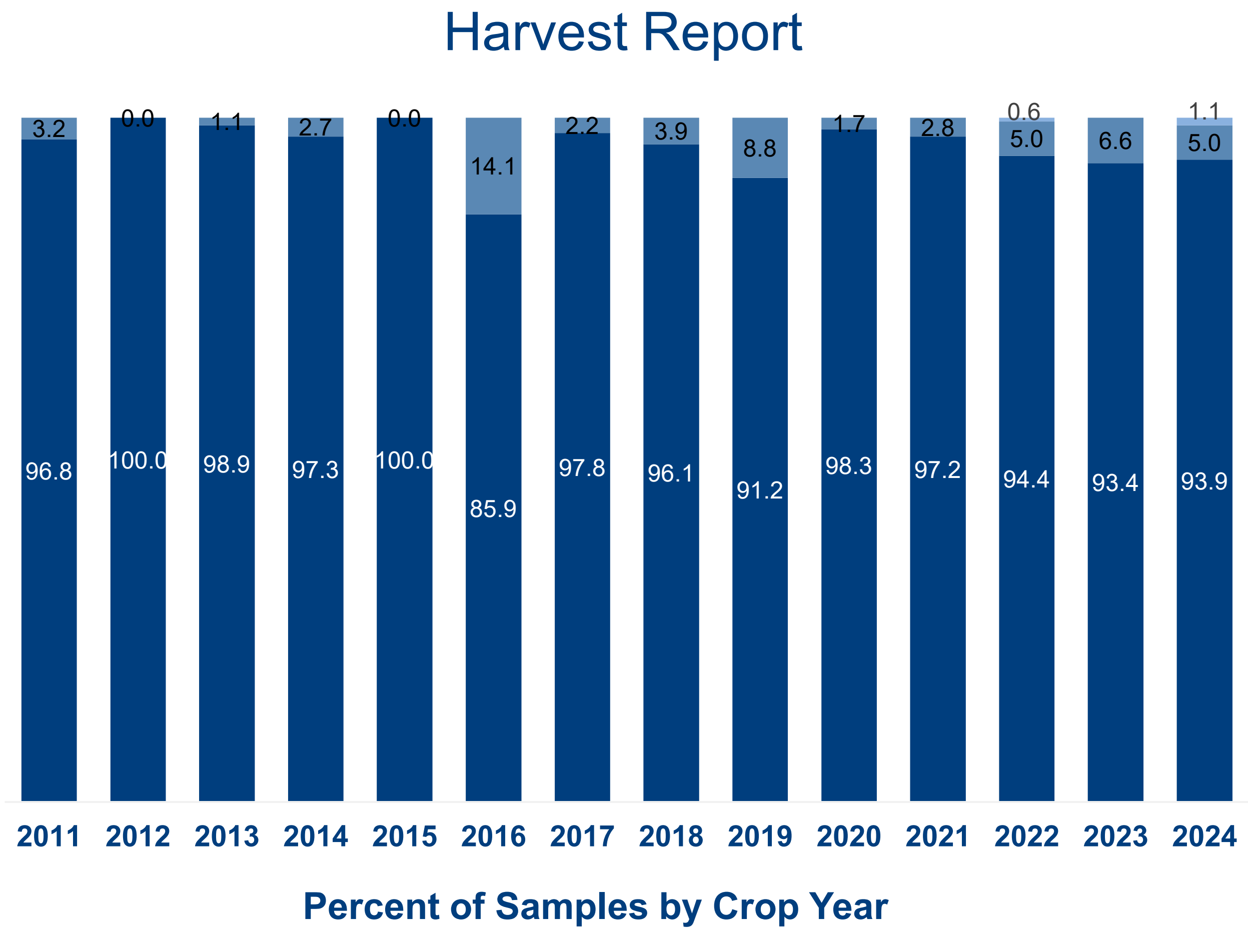
- **96.7%** of samples had DON results **below** 1.5 ppm
- **All** samples had DON results **below** the 5.0 ppm FDA advisory level

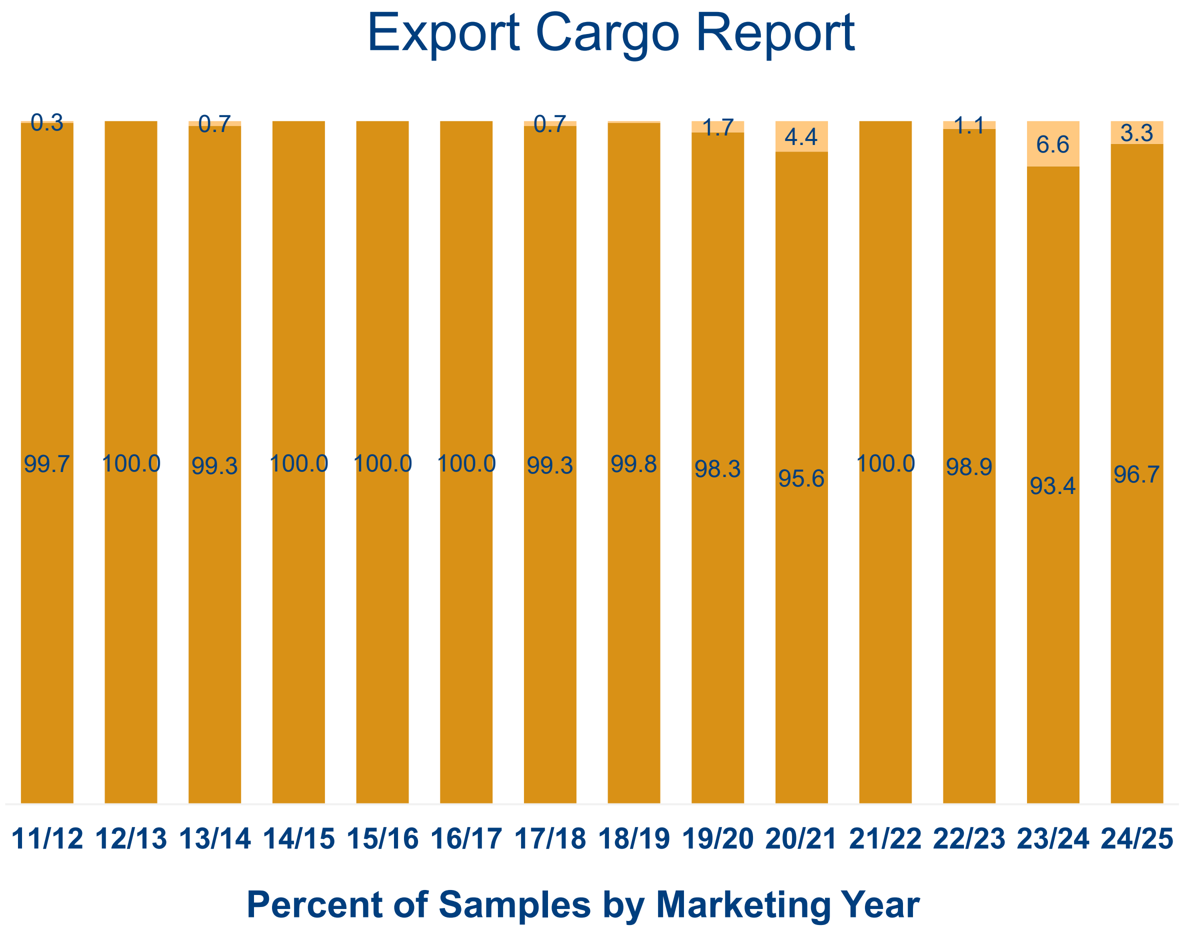


Historical DON (Vomitoxin) Results



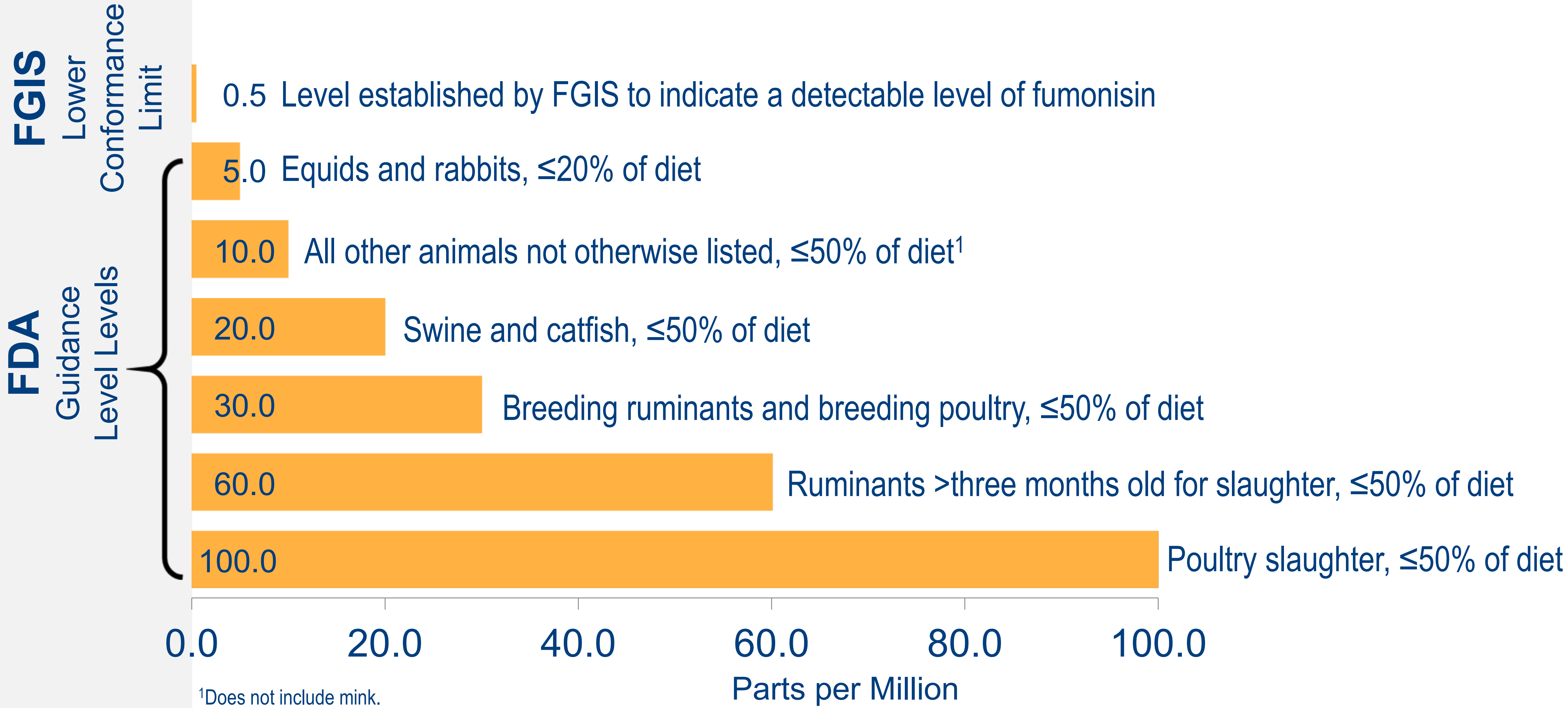
Harvest vs. Export Cargo Historical DON Results (ppm)





<1.5 1.5-5.0 >5.0

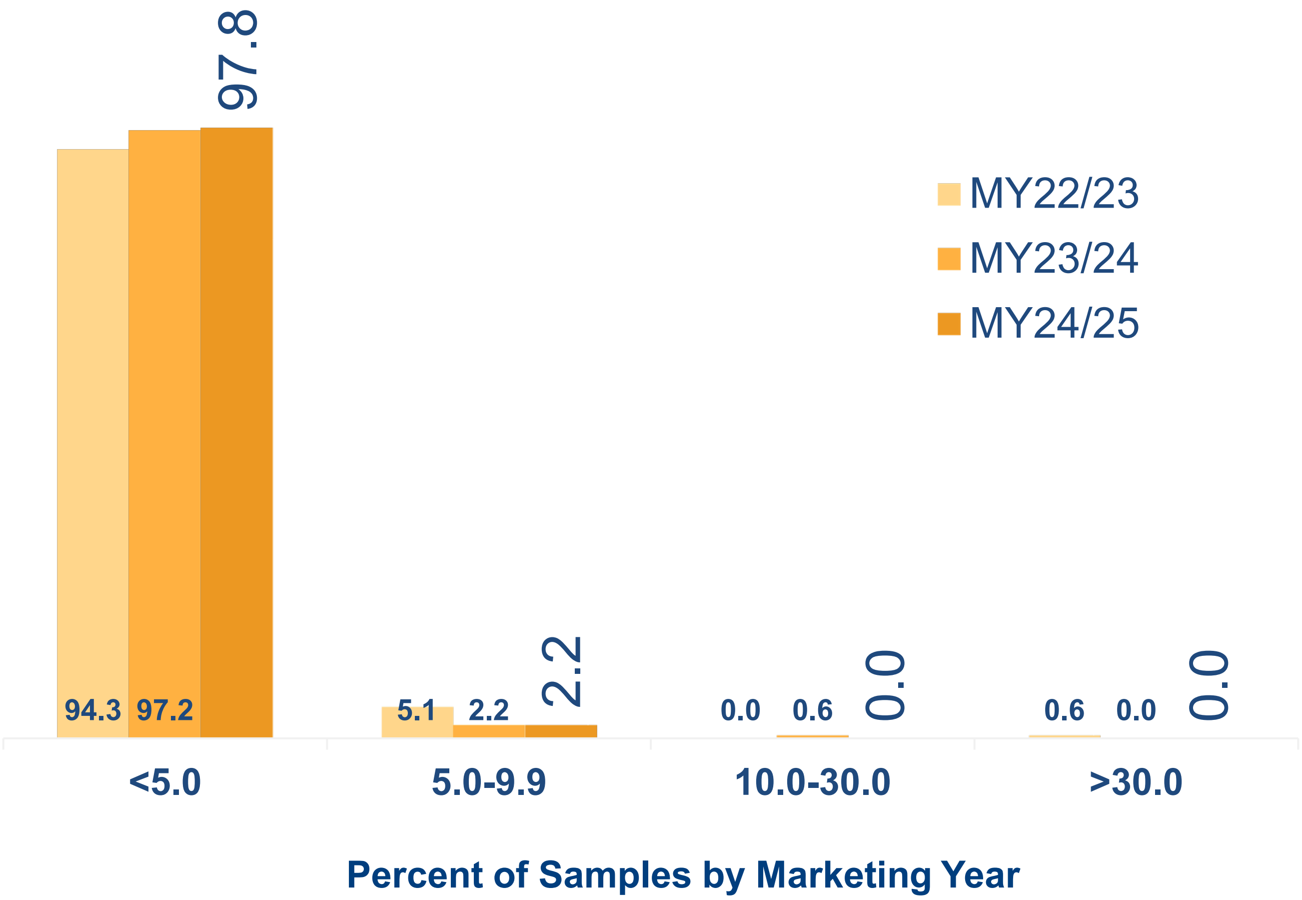
Key Fumonisin Levels (ppm)



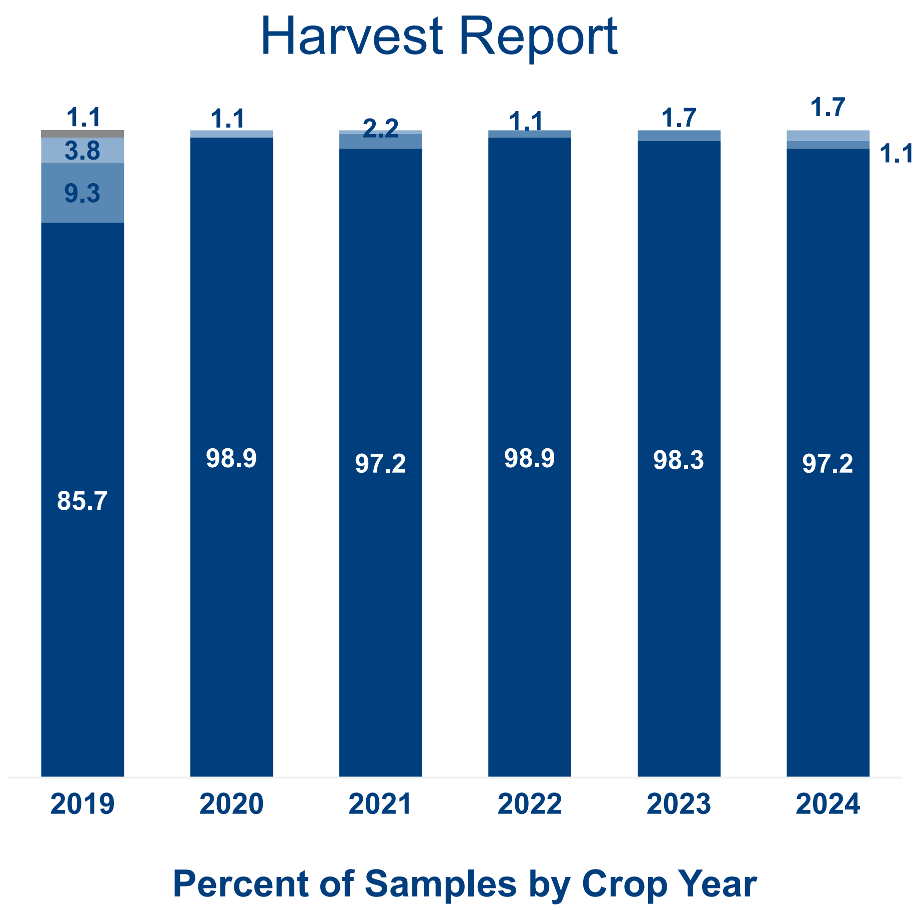
[1]Does not include mink.

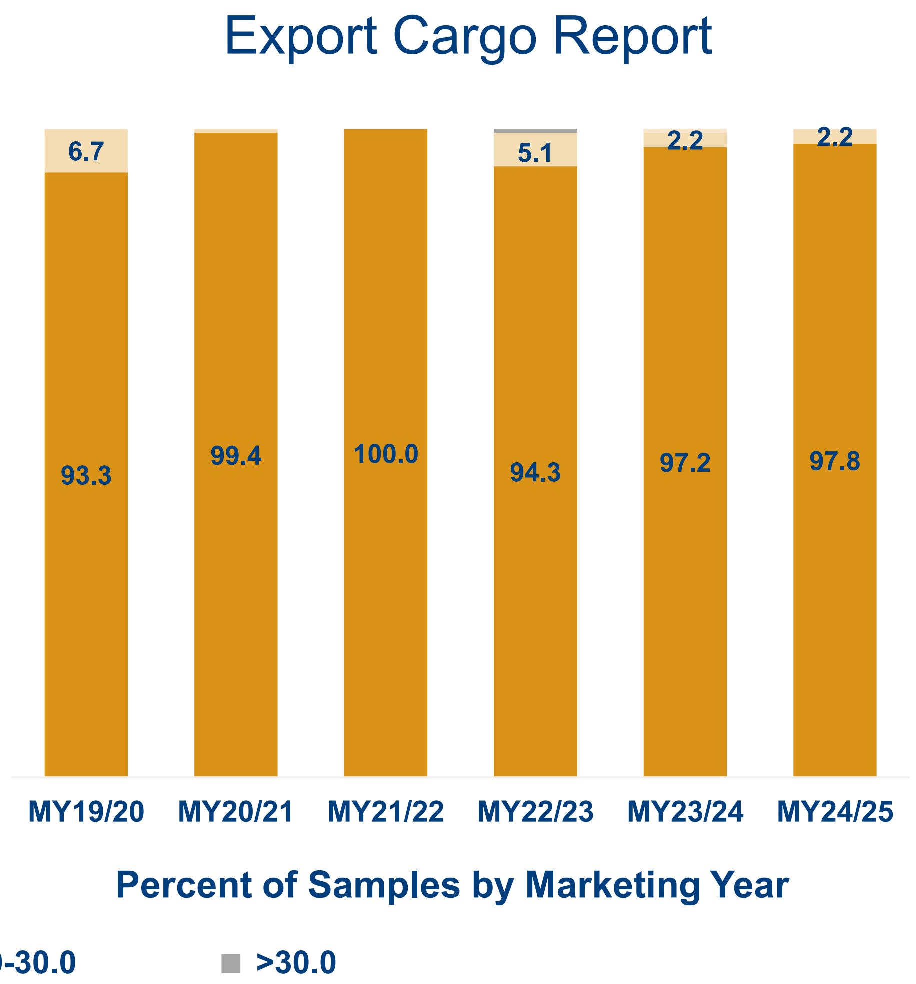
Fumonisin Testing Results (ppm)

- **97.8%** of samples were below the lowest FDA advisory level of 5.0 ppm



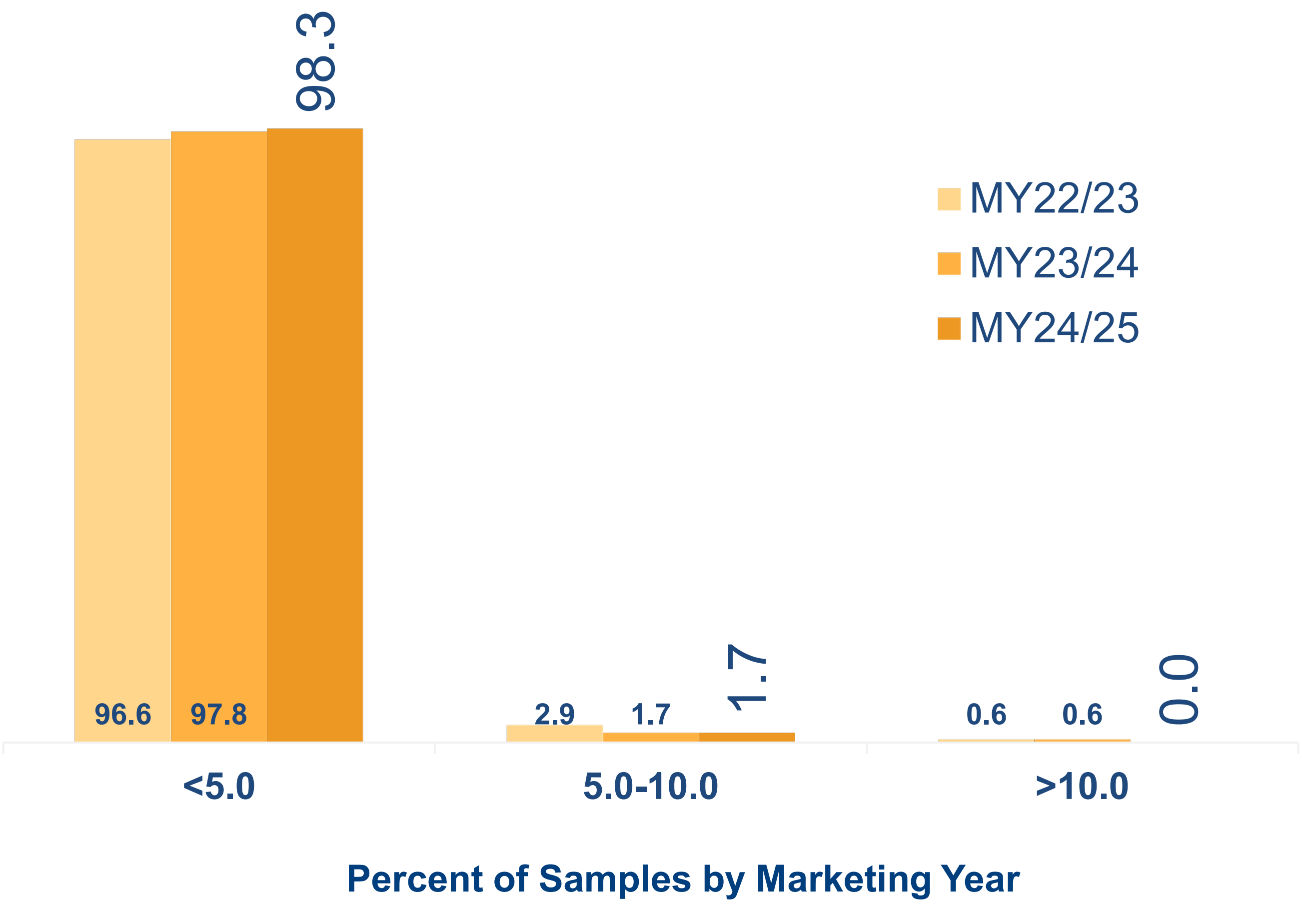
Harvest vs. Export Cargo Fumonisin Results (ppm)





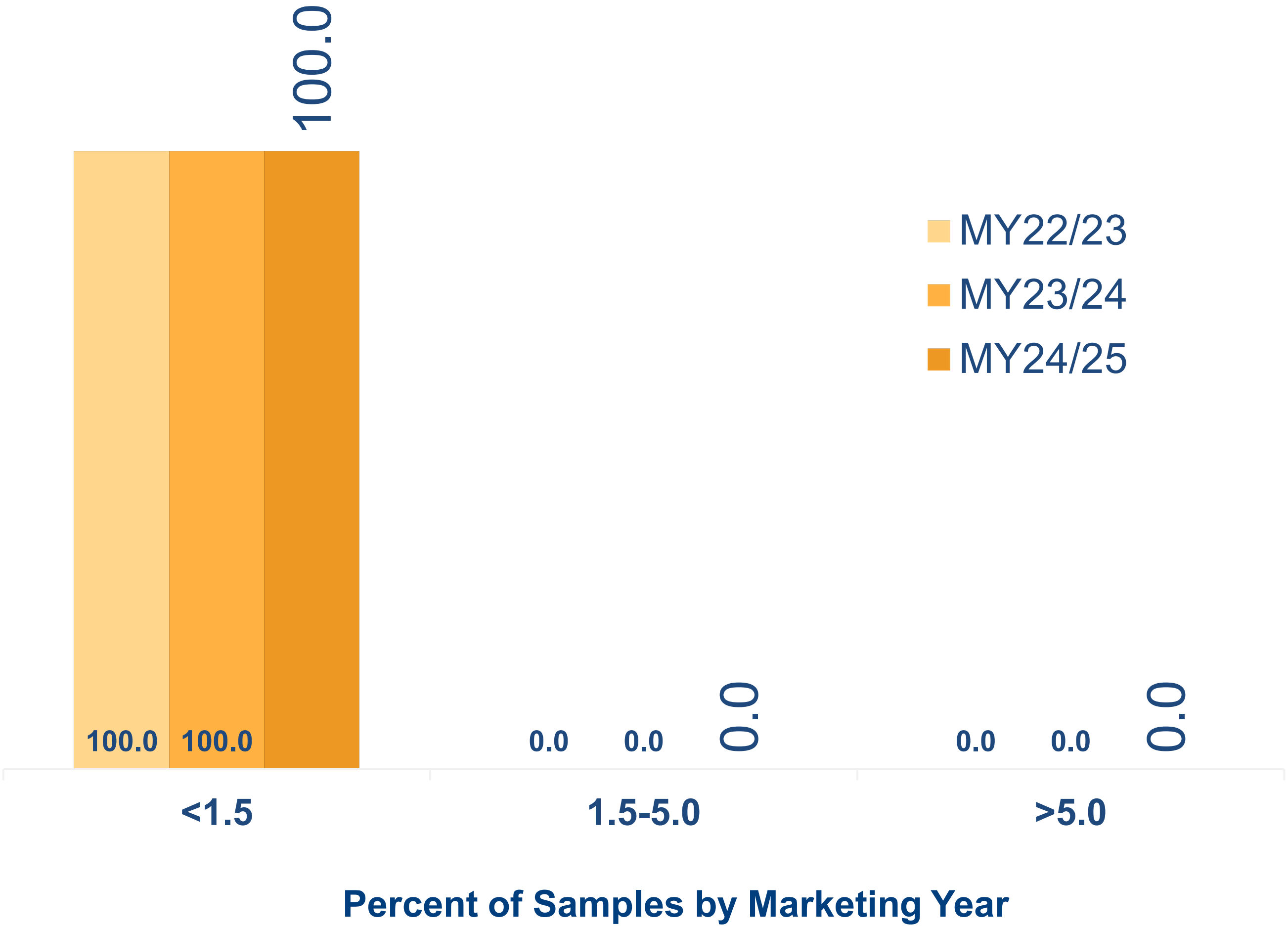
Ochratoxin A Testing Results (ppb)

- **Fourth** year of ochratoxin A testing
- **98.3%** of the samples tested below 5.0 ppb, the European Commission's established maximum level for ochratoxin A.
- The FDA has issued no advisory levels for ochratoxin A.



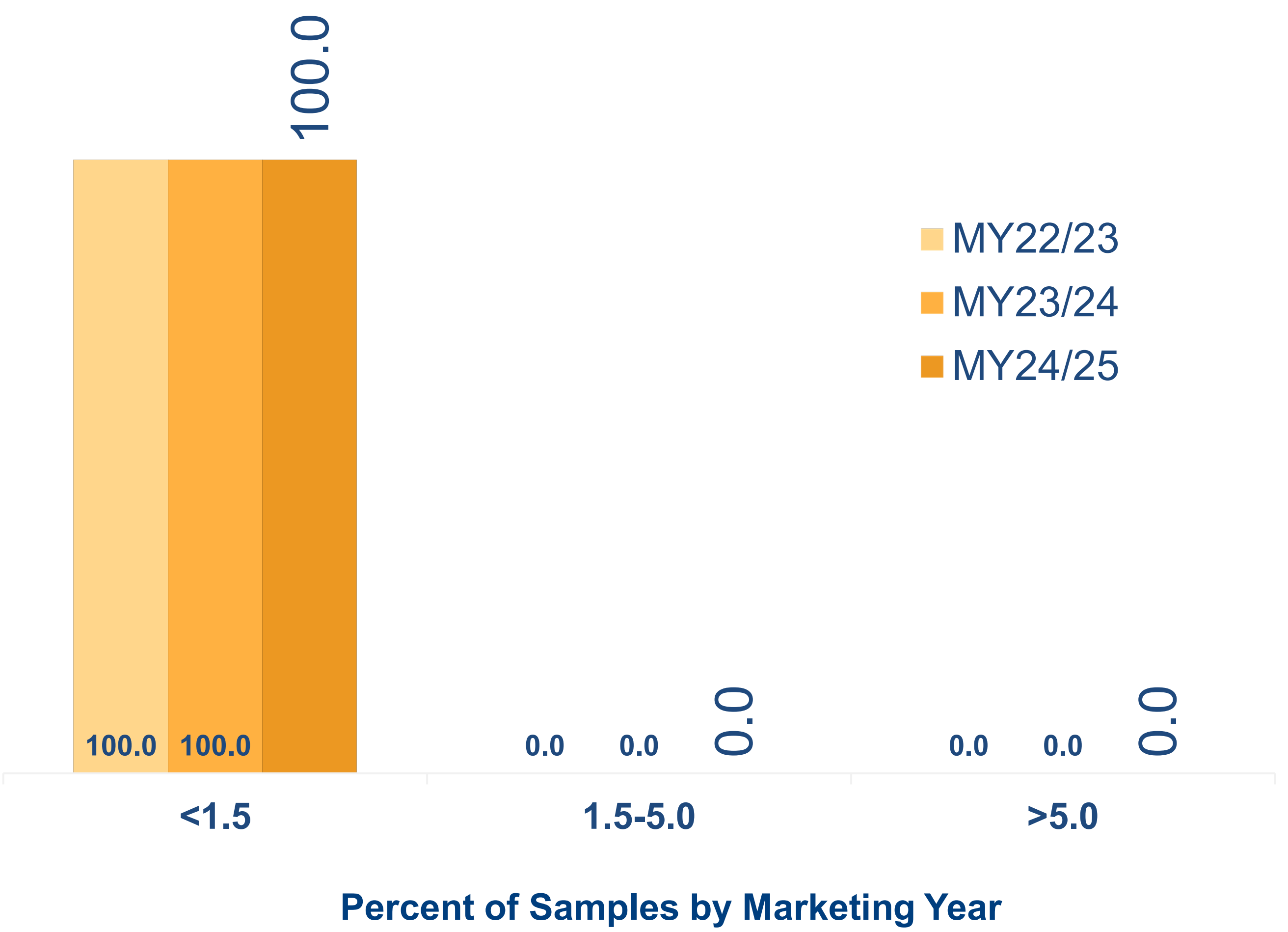
T-2 Testing Results (ppm)

- **Fourth** year of T-2 testing
- **100.0%** of the samples tested below 1.5 ppm



Zearalenone Testing Results (ppm)

- **Fourth** year of zearalenone testing
- **100.0%** of the samples tested below 1.5 ppm



Export Cargo Report Conclusions

- ✓2024/2025 U.S. corn exports were, on average, better than or equal to U.S. No. 2 for all grade factors
- ✓Relative to their respective 5YAs, higher averages for test weight and whole kernels and lower averages for BCFM and total damage were observed.
- ✓Samples reflective of a growing season not conducive to the development of most mycotoxins.

Other Components of the Report

- Quality Test Results
- U.S. Corn Export System
- Survey and Statistical Analysis Methods
- Testing Analysis Methods
- Historical Perspective

Building a Tradition

Thank You!

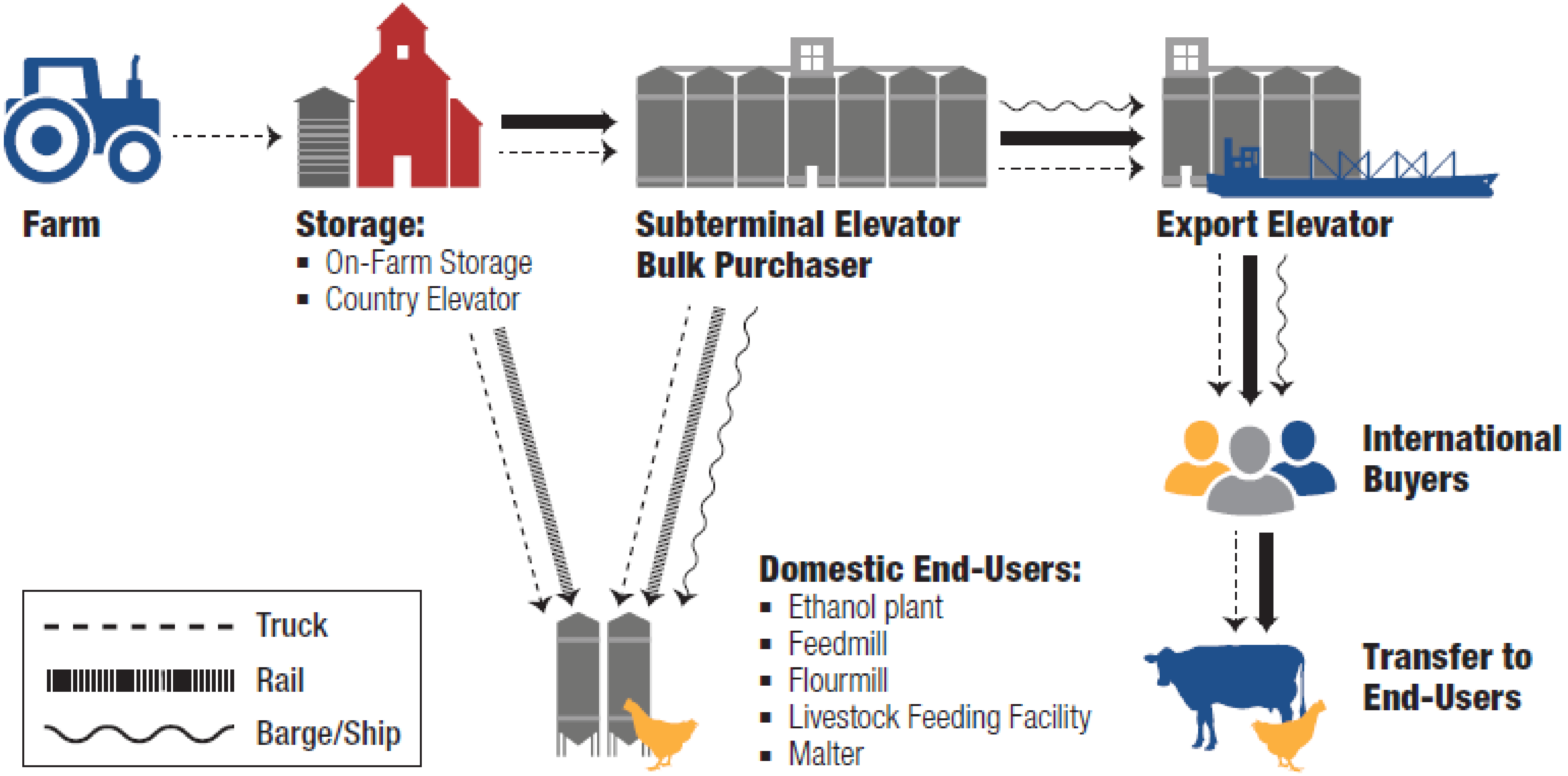
U.S. GRAINS COUNCIL

U.S. Grains Council 2024/2025 Corn Export Quality Report

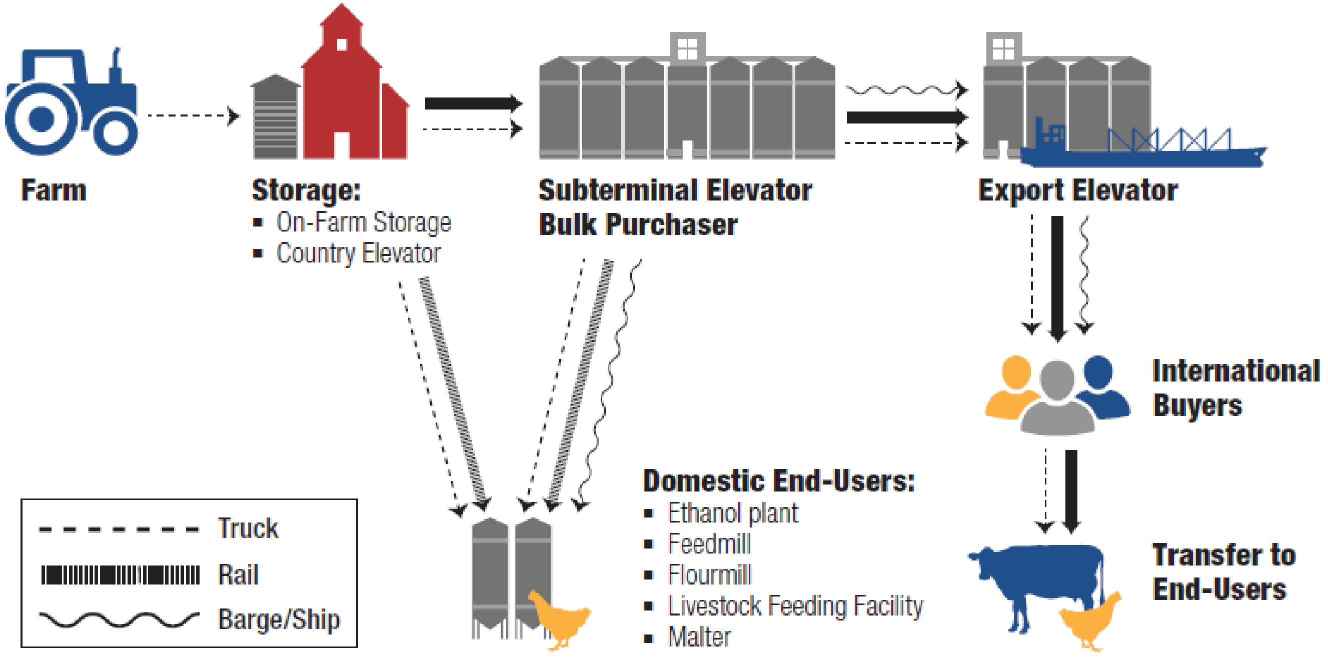
SUPPLEMENTAL SLIDES

U.S. GRAINS COUNCIL

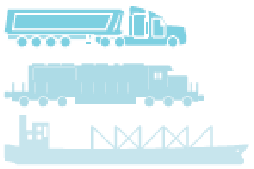
How Does U.S. Grain Move?



How Does U.S. Grain Move?



Grain movement to final domestic users[1]:

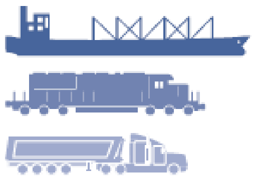


78%

21%

1%

Grain movement to international buyers[1]:



45%

35%

20%

Source: [1]*Transportation of U.S. Grains A Modal Share Analysis*
ams.usda.gov/sites/default/files/media/ModalJune2015.pdf

The United States has:

1.25 million

km of highways (enough to go around the equator 31 times)

225,000

km of railways (more than any other country in the world)

15,800

km of waterways (twice the length of the Nile River)

U.S. GRAINS COUNCIL

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www.grains.org

Testing Analysis Methods

Test Weight (lb/bu or kg/hl)

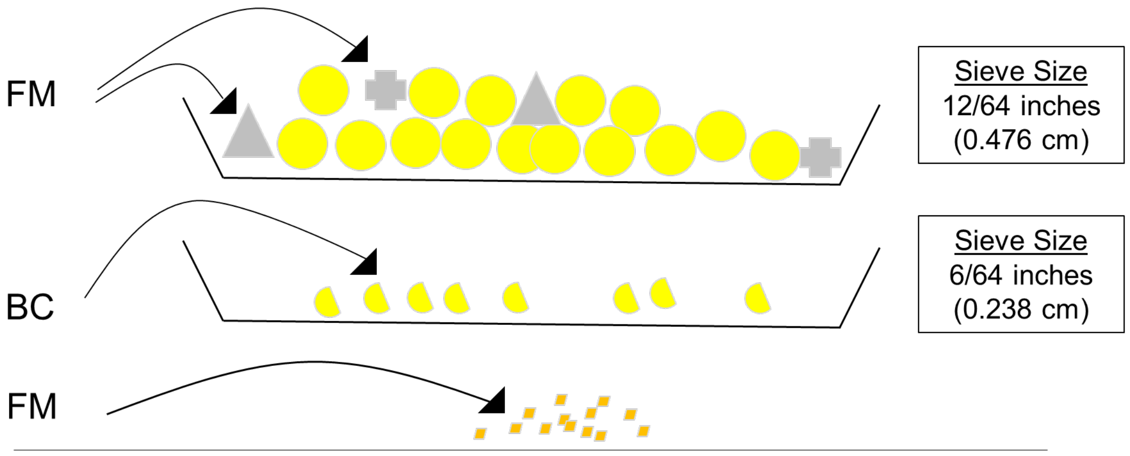
Test weight is a measure of the volume of grain required to fill a Winchester bushel (2,150.42 cubic inches). Test weight is a part of the FGIS Official U.S. Standards for Corn grading criteria.

The test involves filling a test cup of known volume through a funnel held at a specific height above the test cup to the point where grain begins to pour over the test cup's sides. A strike-off stick is used to level the grain in the test cup, and the grain remaining in the cup is weighed. The weight is then converted to and reported in the traditional U.S. unit, pounds per bushel (lb/bu).

Broken Corn & Foreign Material (%)

BCFM is part of the FGIS Official U.S. Standards for Grain and grading criteria.

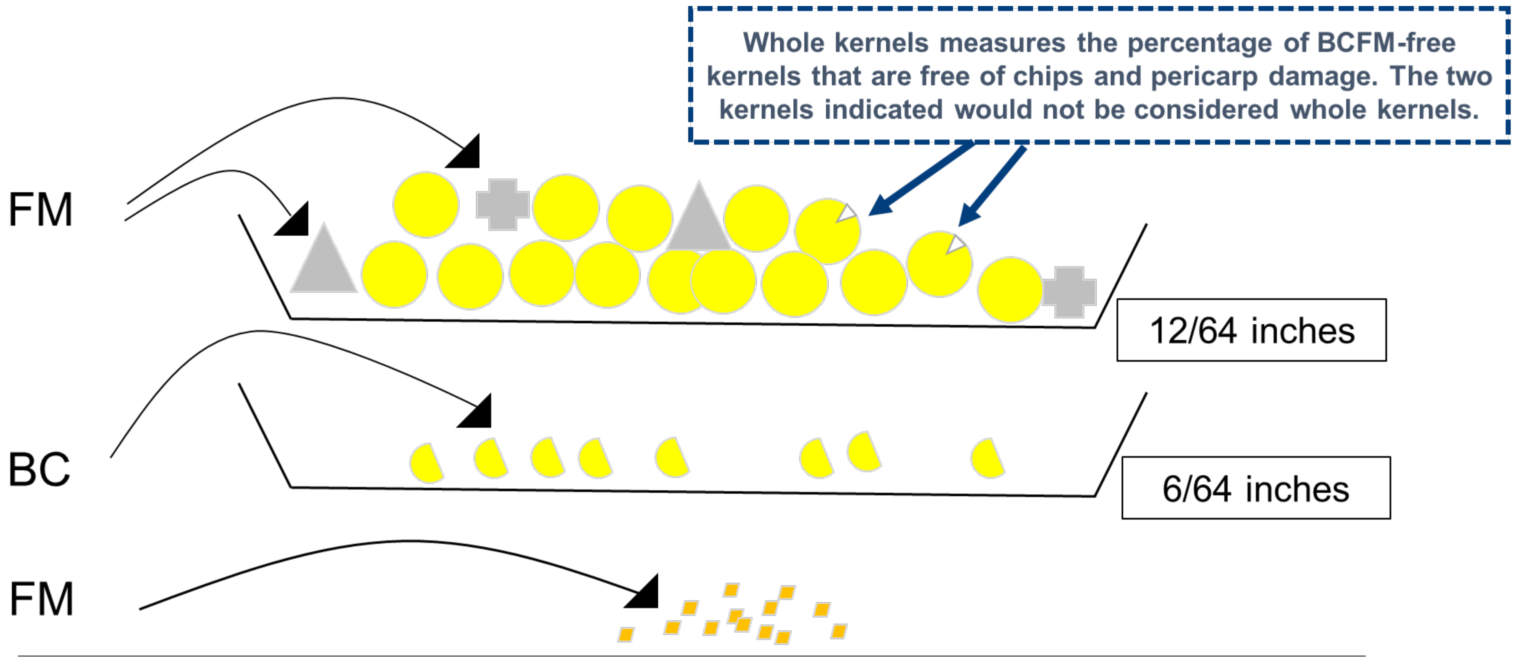
The BCFM test determines the amount of all matter that passes through a 12/64th-inch round-hole sieve and all matter other than corn that remains on the top of the sieve. BCFM measurement can be separated into broken corn and foreign material. Broken corn is defined as all material passing through a 12/64th-inch round-hole sieve and retained on a 6/64th-inch round-hole sieve. The definition of foreign material is all material passing through the 6/64th-inch round-hole sieve and the coarse non-corn material retained on top of the 12/64th-inch round-hole sieve. BCFM is reported as a percentage of the initial sample by weight.



*Measured as percent of weight

Whole Kernels (%)

In the whole kernels test, 50 grams of cleaned (BCFM-free) corn are inspected by the kernel. Cracked, broken or chipped grain, along with any kernels showing significant pericarp damage, are removed. The whole kernels are then weighed, and the result is reported as a percentage of the original 50-gram sample. Some companies perform the same test but report the "cracked & broken" percentage. A whole kernel score of 97.0% equates to a cracked & broken rating of 3.0%.



Total Damage and Heat Damage (%) Moisture (%)

Total damage is part of the FGIS Official U.S. Standards for Grain grading criteria.

A trained and licensed inspector visually examines a representative working sample of 250 grams of BCFM-free corn for damaged kernels. Types of damage include blue-eye mold, cob rot, dryer-damaged kernels (different from heat-damaged kernels), germ-damaged kernels, heat-damaged kernels, insect-bored kernels, mold-damaged kernels, mold-like substance, silk-cut kernels, surface mold (blight), mold (pink Epicoccum) and sprout-damaged kernels. Total damage is reported as the weight percentage of the working sample that is total damaged grain.

Heat damage is a subset of total damage and consists of kernels and pieces of corn kernels that are materially discolored and damaged by heat. Heat-damaged kernels are determined by a trained and licensed inspector visually inspecting a 250-gram sample of BCFM-free corn. Heat damage, if found, is reported separately from total damage.

Chemical Composition

Protein, starch and oil (dry basis %) were determined using near-infrared transmission spectroscopy (NIR) proximate analysis. The technology uses unique interactions of specific wavelengths of light with each sample. It is calibrated to traditional chemistry methods to predict protein, oil and starch concentrations in the sample. This procedure is nondestructive to the corn.

Chemical composition tests for protein, oil and starch were conducted using a 550 to 600-gram sample in a whole-kernel Foss Infratec 1241 NIR instrument. The NIR was calibrated to chemical tests, and the standard errors of predictions for protein, oil and starch were about 0.22%, 0.26% and 0.65%, respectively. Comparisons of the Foss Infratec 1229 used in Harvest Reports before 2016 to the Foss Infratec 1241 on 21 laboratory check samples showed the instruments averaged within 0.25%, 0.26% and 0.25% points of each other for protein, oil and starch, respectively. Results are reported on a dry basis percentage (percent of non-water material).

Stress Cracks (%)

Stress cracks are evaluated by using a backlit viewing board to accentuate the cracks. A sample of 100 intact kernels with no external damage is examined kernel by kernel. The light passes through the horneous or hard endosperm, so each kernel's stress crack damage can be evaluated. Stress cracks, expressed as a percent, are all kernels containing one or more cracks divided by 100 kernels. Lower levels of stress cracks are always better since higher stress cracks lead to more breakage in handling. Some end-users will specify by contract the acceptable level of cracks based on the intended use.

100-Kernel Weight (grams)

The 100-kernel weight is determined from the average weight of two 100-kernel replicates using an analytical balance that measures to the nearest 0.1 milligrams. The averaged 100-kernel weight is reported in grams.

Kernel Volume (cm^3)

The kernel volume for each 100-kernel replicate is calculated using a helium pycnometer and is expressed in cubic centimeters (cm^3) per kernel. Kernel volumes usually range from 0.14 cubic centimeters to 0.36 cubic centimeters per kernel for small and large kernels, respectively.

Kernel True Density (g/cm^3)

True density of each 100-kernel sample is calculated by dividing the mass (or weight) of the 100 externally sound kernels by the volume (displacement) of the same 100 kernels. The two replicate results are averaged. True density is reported in grams per cubic centimeter (g/cm^3). True densities typically range from 1.20 grams per cubic centimeter to 1.30 grams per cubic centimeter at "as is" moisture contents of about 12 to 15%.

Horneous (Hard) Endosperm (%)

The horneous (or hard) endosperm test is performed by visually rating 20 externally sound kernels, placed germ facing up, on a backlit viewing board. Each kernel is rated for the estimated portion of the kernel's total endosperm that is horneous endosperm. The soft endosperm is opaque and will block light, while the horneous endosperm is translucent. The rating is made from standard guidelines based on the degree to which the soft endosperm at the crown of the kernel extends down toward the germ. The average of horneous endosperm ratings for the 20 externally sound kernels is reported. Ratings of horneous endosperm are made on a scale of 70 to 100%, though most individual kernels fall in the 70 to 90% range.

Mycotoxins

For this study, a 1,000-gram laboratory sample was subdivided from the two-kilogram survey sample of shelled kernels for the mycotoxin analysis. The one-kilogram survey sample was ground in a Romer Model 2A mill so that 60 to 75% would pass through a 20-mesh screen. From this well-mixed ground material, a 50-gram test portion was removed for each mycotoxin tested. EnviroLogix AQ 309 BG, AQ 304 BG and AQ 411 BG quantitative test kits were used for the aflatoxin, DON and fumonisin analysis, respectively. EnviroLogix AQ 113 BG, AQ 314 BG, and AQ 412 BG quantitative test kits were used for ochratoxin A, T-2 and zearalenone, respectively.

DON and fumonisin were extracted with water (5:1), while the aflatoxin was extracted with buffered water (3:1). The extracts were tested using the EnviroLogix QuickTox lateral flow strips, and the QuickScan system quantified the mycotoxins.

The limit of detection is defined as the lowest concentration level that can be measured with an analytical method that is statistically different from measuring an analytical blank (absence of a mycotoxin). The limit of detection will vary among different types of mycotoxins, test kits and commodity combinations. Using the test kits mentioned above, the limit of detection was 2.7 parts per billion for aflatoxin, 0.1 parts per million for DON, and 0.1 parts per million for fumonisin.

Mycotoxins (continued)

The EnviroLogix AQ 113 BG quantitative test kit used for the ochratoxin A tests has a limit of detection of 1.5 parts per billion. The ochratoxin A was extracted with a grain buffer (five milliliters per gram).

For the T-2 tests, the AQ 314 BG quantitative test kit has a limit of detection of 50 parts per billion. T-2 was extracted with water (five milliliters per gram).

The EnviroLogix AQ 412 BG quantitative test kit used for the zearalenone tests has a limit of detection of 50 parts per billion. The zearalenone test uses a 25-gram test portion of corn. The zearalenone was extracted using a reagent of EB17 extraction powder and a water buffer of 75 milliliters per sample.