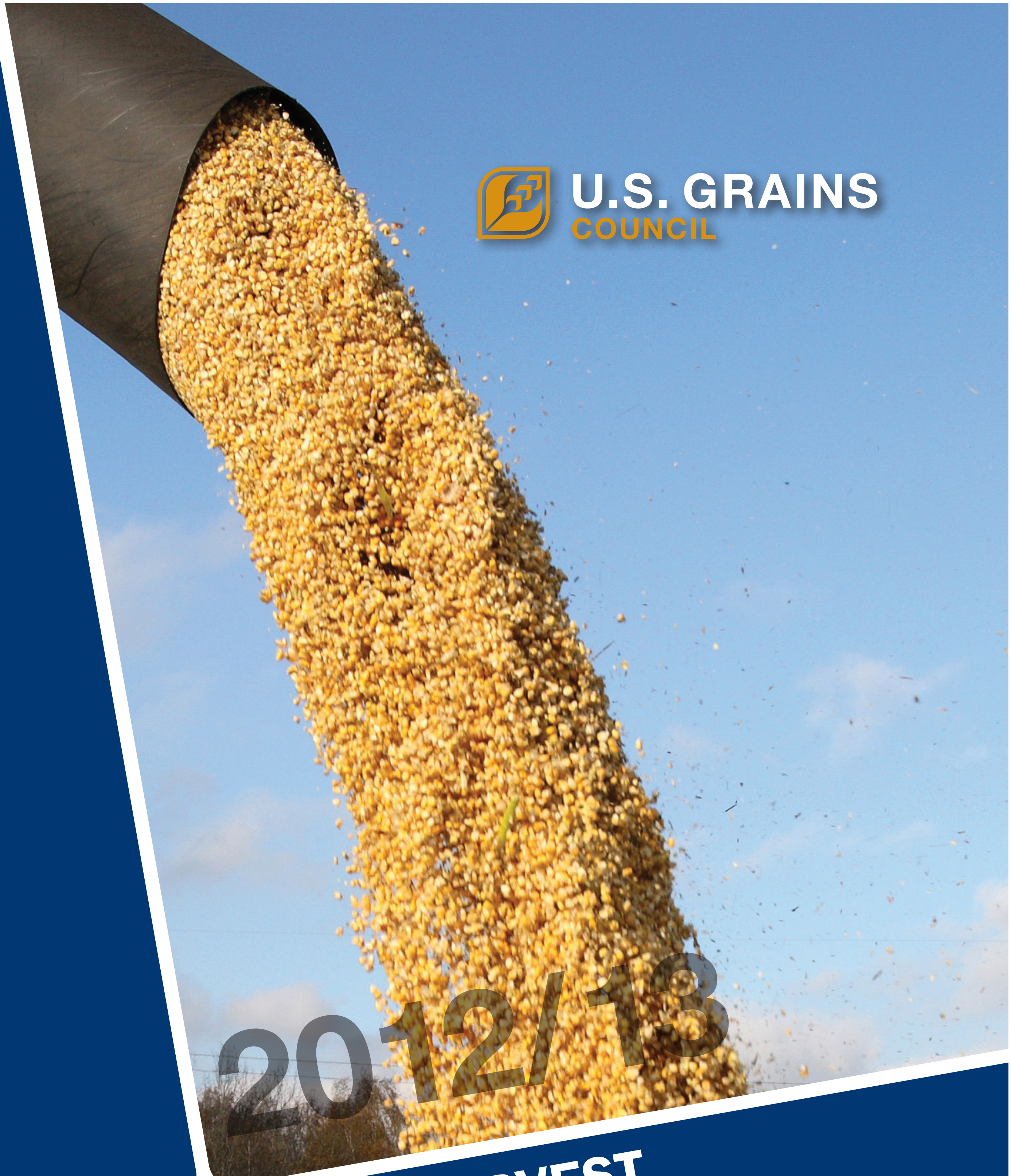

U.S. GRAINS COUNCIL

2012/13

CORN HARVEST
QUALITY REPORT

ACKNOWLEDGEMENTS | 2012 HARVEST

Developing a report of this scope and breadth in a timely manner requires participation by a number of individuals and organizations. The U.S. Grains Council (Council) is grateful to Dr. Sharon Bard and Mr. Chris Schroeder of Centrec Consulting Group, LLC (Centrec) for their oversight and coordination in developing this report. They were supported by internal staff along with a team of experts that helped in data gathering, analysis, and report writing. External team members include Drs. Tom Whitaker, Lowell Hill, Marvin R. Paulsen, and Fred Below. In addition, the Council is indebted to the Illinois Crop Improvement Association's Identity Preserved Grain Laboratory (IPG Lab) and Champaign-Danville Grain Inspection (CDGI) that provided the corn quality testing services.

Finally, this report would not be possible without the thoughtful and timely participation by local grain elevators across the United States. We are grateful for their time and effort in collecting and providing samples during their very busy harvest time.

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GREETINGS FROM THE COUNCIL | 2012 HARVEST

The U.S. Grains Council is pleased to present the *U.S. Grains Council Corn Harvest Quality Report 2012/13*. The Council is committed to the furtherance of global food security and mutual economic benefit through trade. We recognize that the continuous expansion of trade depends on many factors, including access to reliable and timely information about grain quality and availability. As a bridge between international buyers and the world's largest and most sophisticated agricultural production system, the Council offers this report in the hope that it will answer buyers' questions about the quality of the current U.S. crop and assist them in making well-informed decisions.

It should be emphasized that this is a harvest report, which assesses the quality of the current U.S. corn crop as it enters international merchandising channels. Initial corn quality can be subsequently affected by further handling, blending, and storage conditions. This report does not assess these downstream factors; it describes only the initial quality of the current crop. Buyers are encouraged to actively negotiate with shippers on the grade and quality of shipments for which they contract. This report is intended to give buyers reliable information about the quality of the corn at harvest as an aid to these further discussions.

As the second in an annual series, the *Harvest Report 2012/13* further develops a baseline for a long-term database that will become increasingly useful over time. We are, therefore, committed to a consistent and transparent methodology that will build user confidence and permit comparative analysis to previous years. We would also welcome users' criticisms and suggestions on the report's design and presentation.

The global corn market is increasingly competitive, and the Council believes that the availability of accurate, consistent, and comparable information is in the long-term interests of all concerned. Improved information will facilitate increased trade – and when trade works, the world wins.

Sincerely,

Don Fast

Don Fast
Chairman
U.S. Grains Council
November 2012

I. HARVEST QUALITY HIGHLIGHTS | 2012 HARVEST

The 2012 U.S. corn crop was adversely affected by a severe drought across much of the Corn Belt, resulting in reduced total production and lower average yield. Despite the drought, however, the overall quality of the final 2012 corn crop was good.

For most quality factors, the 2012 U.S. corn harvest sample test results reflected higher quality compared to the 2011 harvest. The 2012 corn crop is entering the marketing channel in good condition with the following characteristics:

- High test weight (58.8 lb/bu compared to 58.1 lb/bu in 2011) with 99.7% of the samples above the No. 2 grade minimum, indicating well filled kernels. Metric test weight was 75.6 kg/hl (74.8 kg/hl in 2011).
- Low levels of BCFM (0.8% compared to 1.0% in 2011) along with 94.4% whole kernels (93.8% in 2011), which suggest reduced storage risk.
- Low total damage (0.8% compared to 1.1% in 2011) with no reported heat damage (0% also in 2011).
- Elevator sample moisture average of 15.3% (compared to 15.6% in 2011), implying that much of the corn was field dried which should improve storability and require less drying at the elevators.
- Average protein concentration of 9.4% dry basis, relatively high compared to protein levels in 2011 (8.7%).
- Average starch levels of 73.0% dry basis (73.4% in 2011), signifying relatively good kernel filling and maturation, results beneficial for wet millers.
- Oil content averaging 3.7% dry basis (also 3.7% in 2011).
- Low stress cracks (4% compared to 3% in 2011) which should result in low breakage as corn is handled; suggesting that the corn will perform well in processing with good wet milling starch recovery, high dry milling yields of flaking grits, and good alkaline processing.
- Average true densities of 1.276 g/cm^3 (compared to 1.267 g/cm^3 in 2011) which should be good for wet milling and feeding.
- High percent of horneous (hard) endosperm (85% compared to 84% in 2011).
- Around 86% of the corn samples tested for aflatoxins below the FDA action level of 20 ppb (compared to approximately 98% in 2011).
- 100% of the corn samples tested for DON or vomitoxin below the FDA advisory levels for DON (5 ppm for hogs and other animals and 10 ppm for chicken and cattle) (same as in 2011).

II. Introduction | 2012 HARVEST

The *U.S. Grains Council Corn Harvest Quality Report 2012/13* has been designed to help international buyers of U.S. corn understand the initial quality of U.S. yellow commodity corn as it enters the merchandising channel. This is the second annual survey of the quality of the U.S. corn crop at harvest. With two years of results, the Council was able to draw some preliminary conclusions about the impact of weather and growing conditions on the quality of the U.S. corn as it comes out of the field. Despite the challenging growing conditions and widespread drought experienced by many of the U.S. corn production regions during the 2012 growing season, the United States produced a favorable quality corn crop with slightly higher average test weight, protein levels and density, and lower moisture and BCFM than in 2011.

The Council notes that two years of data only begin to lay the foundation for evaluating the trends and the factors that impact corn quality. As the Council accumulates harvest quality data over several years, the cumulative *Harvest Report* surveys will gain increasing value by enabling export buyers to assess patterns of corn quality based on growing conditions across the years.

This *Harvest Report 2012/13* is based on 637 yellow commodity corn samples taken from areas within 12 of the top corn producing and exporting states. Inbound samples were collected from local grain elevators to observe quality at the point of origin and to provide representative information about the variability of the quality characteristics across the diverse geographic regions.

The sampling areas in the 12 states are divided into three general groupings that are labeled Export Catchment Areas (ECAs). These three ECAs are identified by the three major pathways to export markets:

1. The Gulf ECA consists of areas that typically export corn through U.S. Gulf ports;
2. The Pacific Northwest (PNW) ECA includes areas exporting corn through Pacific Northwest and California ports; and
3. The Southern Rail ECA comprises areas generally exporting corn to Mexico.

Sample test results are reported at the U.S. Aggregate level and for each of the three ECAs, providing a general perspective on the geographic variability of U.S. corn quality.

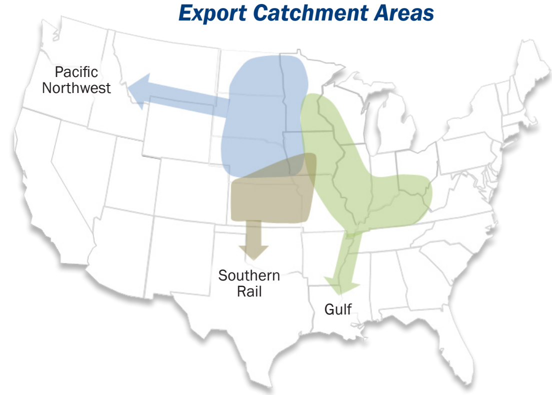
The quality characteristics of the corn identified at harvest establish the foundation for the quality of the grain ultimately arriving at the export customers' doors. However, as corn passes through the U.S. marketing system, it is mingled with corn from other locations, aggregated into trucks, barges and rail cars, stored, and loaded and unloaded several times. Therefore, the quality and condition of the corn change from the point of first sale to the export elevator. For this reason, the *Harvest Report 2012/13* should be considered carefully in tandem with the *U.S. Grains Council Corn Export Cargo Quality Report 2012/13* that will follow early in 2013. As always, the quality of an export cargo of corn is established by the contract between buyer and seller, and buyers are free to negotiate any quality factor that is of importance to them.

This report provides detailed information on each of the quality factors tested, including average and standard deviation for the aggregate of all samples, and for each of the three ECAs. The "Quality Test Results" section summarizes the following quality factors:

- Grade Factors: test weight, broken corn and foreign material (BCFM), total damage, and heat damage
- Moisture
- Chemical Composition: protein, starch, and oil
- Physical Factors: stress cracks/index, 100-kernel weight, kernel volume, kernel true density, whole kernels, and horneous (hard) endosperm
- Mycotoxins: aflatoxin and DON

In addition, this *Harvest Report* includes brief descriptions of the U.S. crop and weather conditions; U.S. corn production, usage and outlook; and detailed descriptions of survey and statistical analysis methods, and testing methods.

Export Catchment Areas



A. Grade Factors

The U.S. Department of Agriculture's Federal Grain Inspection Service (FGIS) has established numerical grades, definitions and standards for measurement of many quality factors. The attributes which determine the numerical grades are test weight, broken corn and foreign material (BCFM), total damage, and heat damage. The corn grades and grade requirements are summarized in the "U.S. Corn Grades and Conversions" section on page 45.

1. Test Weight

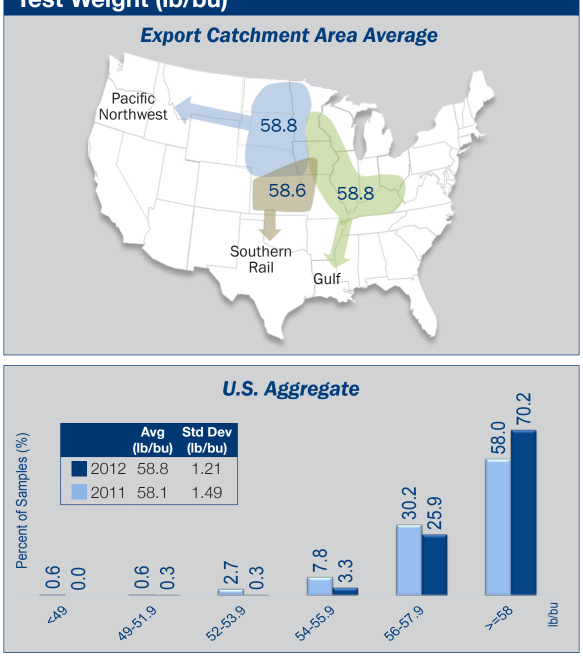
U.S. Grade Minimum Test Weight
No. 1: 56.0 lbs
No. 2: 54.0 lbs
No. 3: 52.0 lbs

Test weight (weight per volume) is a measure of bulk density and is often used as a general indicator of overall quality and as a gauge of endosperm hardness for alkaline cookers and dry millers. High test weight corn will take up less storage space than the same weight of corn with a lower test weight. Test weight is initially impacted by genetic differences in the structure of the kernel. However, it is also affected by moisture content, method of drying, physical damage to the kernel (broken kernels and scuffed surfaces), foreign material in the sample, kernel size, stress during the growing season, and microbiological damage. When sampled and measured at the point of delivery from the farm at a given moisture content, high test weight generally indicates high quality, high percent of horneous (or hard) endosperm and sound, clean corn. Test weight is highly correlated to true density and reflects kernel hardness and kernel maturity.

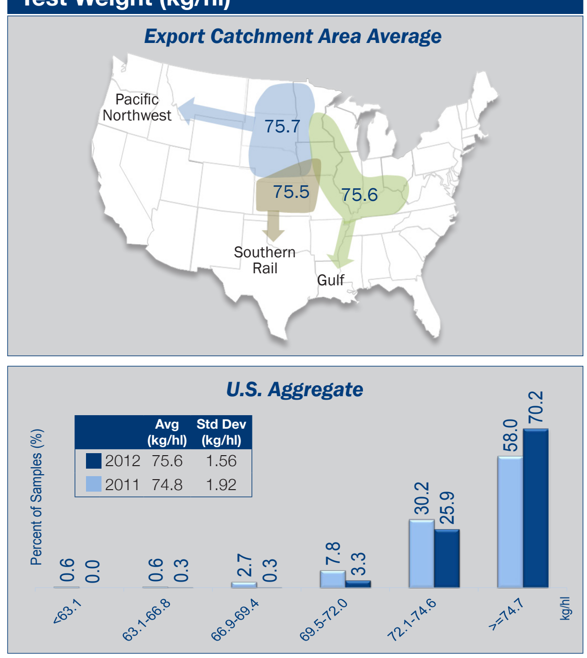
HIGHLIGHTS

- The U.S. Aggregate average test weight of 58.8 lb/bu (75.6 kg/hl) indicates overall good quality and is more than 2 lb/bu above the grade limit for U.S. No. 1 corn (56 lbs).
- Average test weight in 2012 was higher than in 2011 in all ECAs, and all samples were above the grade limit for U.S. No. 1.
- Values for individual samples ranged from 49.4 to 62.5 lb/bu, with a standard deviation of 1.21, below that of the 2011 crop indicating less variability in the samples tested.
- Test weight values were distributed with 99.4% of the samples above the factor limit for U.S. No. 2 grade and 96.1% above the No. 1 limit of 56 lb/bu.
- As corn is commingled moving through the marketing channel, the average test weight in each ECA is not likely to fall below the minimum for U.S. No. 2 grade.
- Uniformity of samples was greater in the 2012 crop relative to values in the 2011 crop as indicated by the lower standard deviation in all ECAs.

Test Weight (lb/bu)



Test Weight (kg/hl)



III. QUALITY TEST RESULTS | 2012 HARVEST

2. Broken Corn and Foreign Material (BCFM)

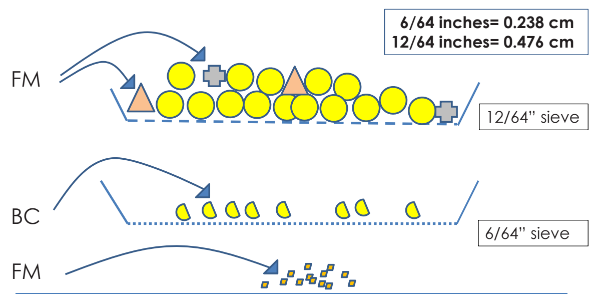
U.S. Grade BCFM Max Limits
No. 1: 2.0%
No. 2: 3.0%
No. 3: 4.0%

Broken corn and foreign material (BCFM) is an indicator of the amount of clean, sound corn available for feed and processing. The lower the percentage of BCFM, the less foreign material and/or fewer broken kernels are in a sample. Higher levels of BCFM in farm-originated samples generally stem from combine settings and/or weed seeds in the field.

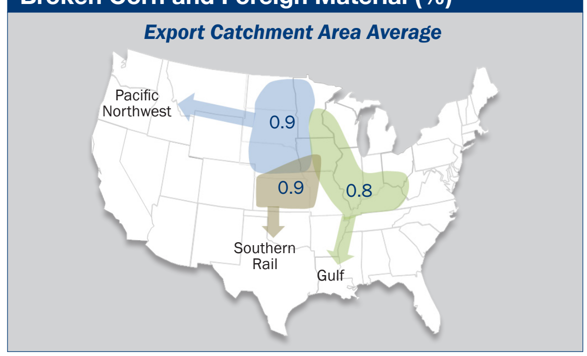
Broken corn is defined as everything small enough to pass through a 12/64th inch round-hole sieve, but too large to pass through a 6/64th inch round-hole sieve.

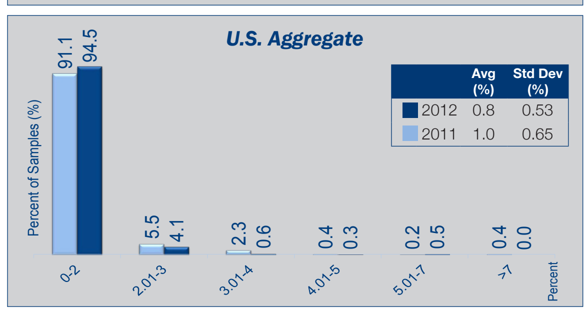
Foreign material is defined as any non-corn pieces too large to pass through a 12/64th inch round-hole sieve, as well as all fine material small enough to pass through a 6/64th inch round-hole sieve.

BCFM (Measured as Percent by Weight)



Broken Corn and Foreign Material (%)





HIGHLIGHTS

- Average BCFM for the U.S. Aggregate was 0.8% compared to 1.0% in 2011.
- Uniformity of samples was greater in the 2012 crop relative to values in the 2011 crop as indicated by the lower standard deviation in all ECAs.
- BCFM U.S. Aggregate values ranged from 0.1 to 5.7% with a standard deviation of 0.53% compared to 0.65% in 2011. None of the ECAs differed substantially from the U.S. Aggregate.
- BCFM U.S. Aggregate values were distributed with 94.5% of the samples containing 2% or less.
- BCFM levels in almost all (98.6%) of the corn samples were well below the maximum of 3% allowed for U.S. No. 2 corn.
- BCFM levels will normally increase during drying and handling, depending on the methods used and the soundness of the kernels.

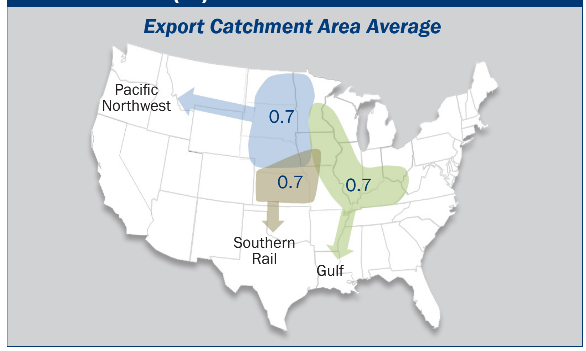
3. Broken Corn

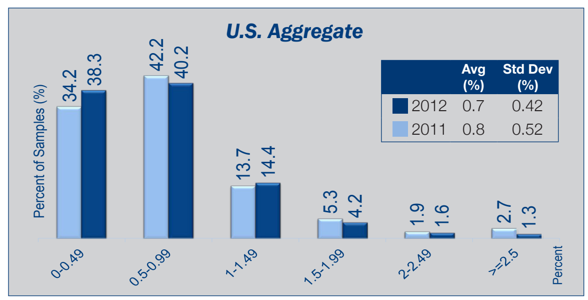
Broken corn is more subject to mold and insect damage than whole kernels and can cause problems in handling and processing. When not spread or stirred in a storage bin, broken corn tends to stay in the center of the bin while whole kernels are likely to gravitate to the outer edges. This phenomenon is known as a "spoutline" in the grain business. In some cases, most, if not all, of the spoutline can be removed by pulling grain out of the center draw.

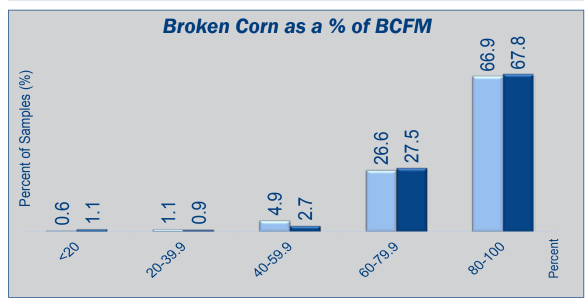
HIGHLIGHTS

- Broken corn in the U.S. Aggregate values averaged 0.7% in 2012 (0.8% in 2011).
- These low levels suggest the corn will store and handle well in the market channel.
- Broken corn in the U.S. Aggregate values ranged from 0 to 4.8% with a standard deviation of 0.42% (0.52% in 2011) indicating slightly less variability than in 2011.
- Broken corn U. S. Aggregate values were distributed with 38.3% less than 0.5% and 78.5 % less than 1.0% broken corn.
- Broken corn average values in the individual ECAs in 2012 were the same as the U.S. Aggregate.
- The distribution chart to the right, displaying broken corn as a percent of BCFM, shows that in nearly all samples, BCFM consisted primarily of broken corn.

Broken Corn (%)







III. QUALITY TEST RESULTS | 2012 HARVEST

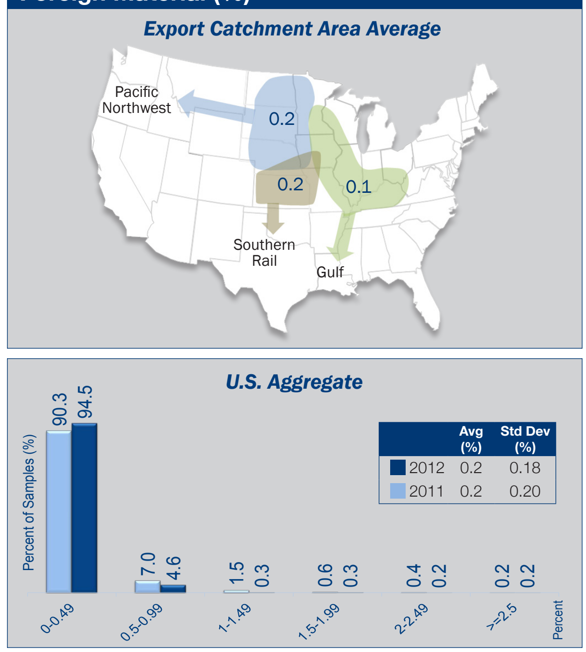
4. Foreign Material

Foreign material is of importance in that it has little feed or processing value, it is generally higher in moisture content than the corn and therefore creates a potential for deterioration of corn during storage. Foreign material also contributes to the spoutline and is more serious than broken corn because of the higher moisture level as mentioned above.

HIGHLIGHTS

- Foreign material in the U.S. Aggregate averaged 0.2% in 2012 (the same as in 2011) and 94.5% of the samples contained less than 0.5% FM.
- All ECAs had average foreign material values equal to or less than 0.2%, differing little from the 2011 crop.
- High levels of foreign material found in a few of the samples can be readily cleaned to minimize any significant handling problems.
- Variability among the U.S. Aggregate samples in 2012 was less than in 2011 with a standard deviation of 0.18% in 2012 compared to 0.20% in 2011.

Foreign Material (%)



5. Total Damage

Total damage is the percentage of kernels and pieces of kernels that are visually damaged in some way, including damage from heat, frost, insect, sprout, disease, weather, ground, germ, and mold. Most of these types of damage result in some sort of discoloration or change in kernel texture. Damage does not include broken pieces of grain that are otherwise normal in appearance.

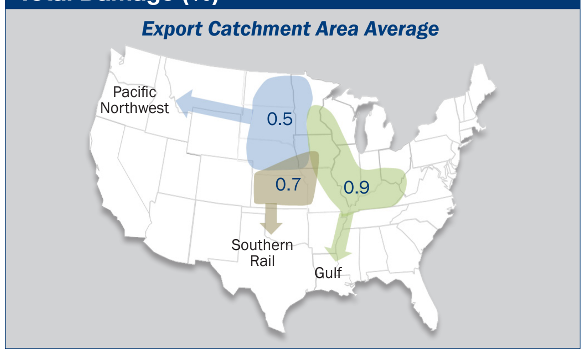
U.S. Grade Total Damage Max Limits
No. 1: 3.0%
No. 2: 5.0%
No. 3: 7.0%

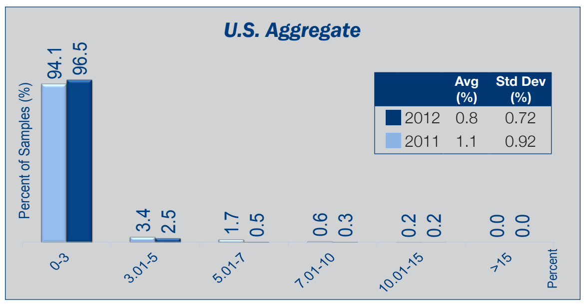
Mold damage is usually associated with higher moisture content and high temperature in growing and/or storage. Mold damage and the associated potential for mycotoxins is the damage factor of greatest concern. Mold damage can occur prior to harvest as well as during temporary storage at high moisture and high temperature levels before delivery.

HIGHLIGHTS

- Total damage in the U.S. Aggregate samples averaged 0.8% in 2012 (1.1% in 2011) indicating good quality at harvest.
- Total damage in the U.S. Aggregate samples ranged from 0.0 to 12.7% with a standard deviation of 0.72% indicating greater uniformity among samples than in 2011.
- Total damage in the U.S. Aggregate samples were distributed with 96.5% of the samples having 3% or less damaged kernels, and 99.0% having less than 5%.
- Total damage average values in Gulf, Pacific Northwest, and Southern Rail ECAs were 0.9%, 0.5%, and 0.7% respectively. These levels are well below the limit for U.S. No. 1 corn (3.0%) indicating that total damage was not a problem in farm deliveries.

Total Damage (%)





6. Heat Damage

Heat damage is a subset of total damage and has separate allowances in the U.S. Grade standards. Heat damage can be caused by microbiological activity in warm, moist grain or by high heat applied during drying. Heat damage is seldom present in corn delivered at harvest directly from farms.

U.S. Grade Heat Damage Max Limits
No. 1: 0.1%
No. 2: 0.2%
No. 3: 0.5%

HIGHLIGHTS

- There was no heat damage reported in any of the samples, the same results as in 2011.
- The absence of heat damage likely was due in part to fresh samples coming directly from farm to elevator with minimal prior drying.

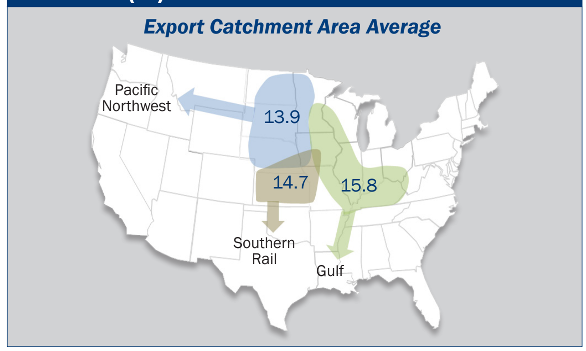
B. Moisture

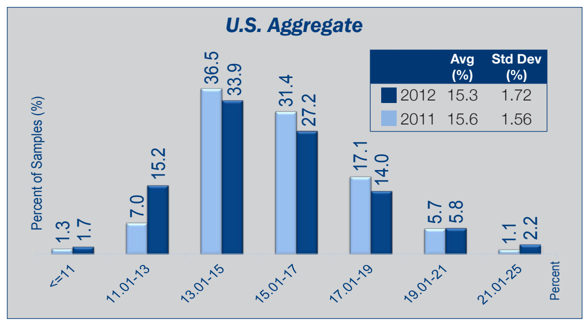
Moisture content is reported on official grade certificates, but does not determine which numerical grade will be assigned to the sample. Moisture content affects the amount of dry matter being sold and purchased. Moisture is also an indicator for drying that might be needed, has potential implications for storability, and affects test weight. Higher moisture content at harvest increases kernel damage during harvesting and drying, and the amount of drying required will affect stress cracks, breakage, and germination. Extremely wet grain may be a precursor to high mold damage later in storage or transport. While the weather during the growing season affects yield and the development of the grain, grain harvest moisture is influenced largely by the timing and harvest weather conditions.

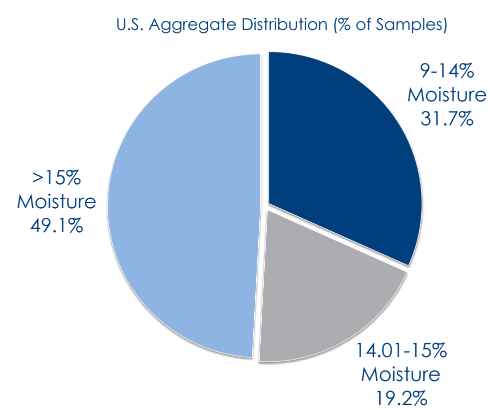
HIGHLIGHTS

- The U.S. Aggregate elevator-recorded moisture averaged 15.3% with a minimum of 8.9% and a maximum of 24.7%.
- The U.S. Aggregate moisture was lower in 2012 than 2011 (15.3% compared to 15.6%) but the range and standard deviation were slightly greater.
- The U.S. Aggregate moisture values were distributed with 50.9% of the samples containing 15% or less moisture. This is the base used by most elevators for discounts and is a level considered storable for short periods. This was an improvement over the 44.8% in the 2011 crop. 31.7% of the samples contained 14% or less moisture compared to 21.1% in 2011 which is generally considered a safe level for storage and transport without drying.
- The U.S. Aggregate moisture averages for corn from the Gulf, Pacific Northwest, and Southern Rail ECAs were 15.8%, 13.9% and 14.7%, respectively.
- The Gulf ECA average moisture was the highest of the three ECAs in both 2012 and 2011. The high 2012 Gulf ECA average moistures may have been due in part to the earlier than normal harvest in many of the areas in the Gulf ECA.

Moisture (%)







III. QUALITY TEST RESULTS | 2012 HARVEST

SUMMARY: GRADE FACTORS AND MOISTURE

- The quality of the 2012 crop samples was slightly better on all grade factors than the 2011 crop samples, although both were high quality at the point of first delivery.
- Test weight was high with U.S. Aggregate samples averaging 58.8 lb/bu (75.6 kg/hl).
- BCFM of incoming corn was very low with a U.S. Aggregate average of 0.8%, consisting primarily of broken corn.
- Average total damage was extremely low for incoming corn, ranging from 0.5 to 0.9% among ECAs. The range among samples was from 0.0 to 12.7% with only one sample above 5%. In addition, no heat damage was reported on any of the samples.
- Of the inbound elevator samples, 98.6% would grade U.S. No. 2 or better on all grade determining factors (the criteria found in most export contracts). Over time, subsequent handling, drying, and storage may cause quality to be lower.
- The U.S. Aggregate elevator-recorded moisture averaged 15.3% with 50.9% of the samples containing 15% or less moisture. In addition, 31.7% contained 14% or less, requiring no high temperature drying. Drought conditions in many regions resulted in a higher percentage of the crop drying in the field, resulting in less artificial drying and increasing the overall quality of the 2012 corn crop.

SUMMARY: GRADE FACTORS AND MOISTURE

	2012 Harvest					2011 Harvest		
	No. of Samples[1]	Avg.	Std. Dev.	Min.	Max.	No. of Samples[1]	Avg.	Std. Dev.
U.S. Aggregate								
Test Weight (lb/bu)	637	58.8*	1.21	49.4	62.5	474	58.1	1.49
Test Weight (kg/hl)	637	75.6*	1.56	63.6	80.4	474	74.8	1.92
BCFM (%)	637	0.8*	0.53	0.1	5.7	474	1.0	0.65
Broken Corn (%)	637	0.7*	0.42	0.0	4.8	474	0.8	0.52
Foreign Material (%)	637	0.2*	0.18	0.0	3.9	474	0.2	0.20
Total Damage (%)	637	0.8*	0.72	0.0	12.7	474	1.1	0.92
Heat Damage (%)	637	0.0	0.00	0.0	0.0	474	0.0	0.00
Moisture (%)	637	15.3*	1.72	8.9	24.7	474	15.6	1.56
Gulf								
Test Weight (lb/bu)	566	58.8*	1.24	49.4	62.5	364	58.3	1.48
Test Weight (kg/hl)	566	75.6*	1.59	63.6	80.4	364	75.0	1.91
BCFM (%)	566	0.8*	0.52	0.1	5.7	364	0.9	0.62
Broken Corn (%)	566	0.7*	0.41	0.0	4.8	364	0.7	0.49
Foreign Material (%)	566	0.1*	0.18	0.0	3.9	364	0.2	0.19
Total Damage (%)	566	0.9*	0.84	0.0	12.7	364	1.3	1.09
Heat Damage (%)	566	0.0*	0.00	0.0	0.0	364	0.0	0.00
Moisture (%)	566	15.8	1.81	8.9	24.7	364	16.0	1.67
Pacific Northwest								
Test Weight (lb/bu)	321	58.8*	1.15	49.4	62.3	182	57.3	1.57
Test Weight (kg/hl)	321	75.7*	1.48	63.6	80.2	182	73.7	2.03
BCFM (%)	321	0.9*	0.58	0.1	5.6	182	1.1	0.75
Broken Corn (%)	321	0.7*	0.47	0.0	4.4	182	0.9	0.58
Foreign Material (%)	321	0.2*	0.17	0.0	1.5	182	0.2	0.23
Total Damage (%)	321	0.5*	0.40	0.0	4.9	182	0.6	0.36
Heat Damage (%)	321	0.0*	0.00	0.0	0.0	182	0.0	0.00
Moisture (%)	321	13.9*	1.42	8.9	21.4	182	14.7	1.28
Southern Rail								
Test Weight (lb/bu)	366	58.6	1.19	49.4	62.4	149	58.5	1.39
Test Weight (kg/hl)	366	75.5	1.53	63.6	80.3	149	75.3	1.79
BCFM (%)	366	0.9*	0.53	0.1	5.7	149	1.1	0.67
Broken Corn (%)	366	0.7*	0.42	0.0	4.8	149	0.9	0.53
Foreign Material (%)	366	0.2*	0.18	0.0	2.0	149	0.2	0.18
Total Damage (%)	366	0.7*	0.60	0.0	5.1	149	1.3	0.90
Heat Damage (%)	366	0.0*	0.00	0.0	0.0	149	0.0	0.00
Moisture (%)	366	14.7	1.75	8.9	22.7	149	14.9	1.42

**Indicates averages in 2012 were significantly different from 2011 based on a 2-tailed t-test at the 95% level of significance.*

[1]Due to the ECA results being composite statistics, the sum of the sample numbers from the three ECAs is greater than the U.S. Aggregate.

III. QUALITY TEST RESULTS | 2012 HARVEST

C. Chemical Composition

Chemical composition of corn is important because the components of protein, starch and oil are of significant interest to end users. The chemical composition attributes are not grade factors. However, they provide additional information related to nutritional value for livestock and poultry feeding and for wet milling uses, and other processing uses of corn. Unlike many physical attributes, chemical composition values are not expected to change significantly during storage or transport.

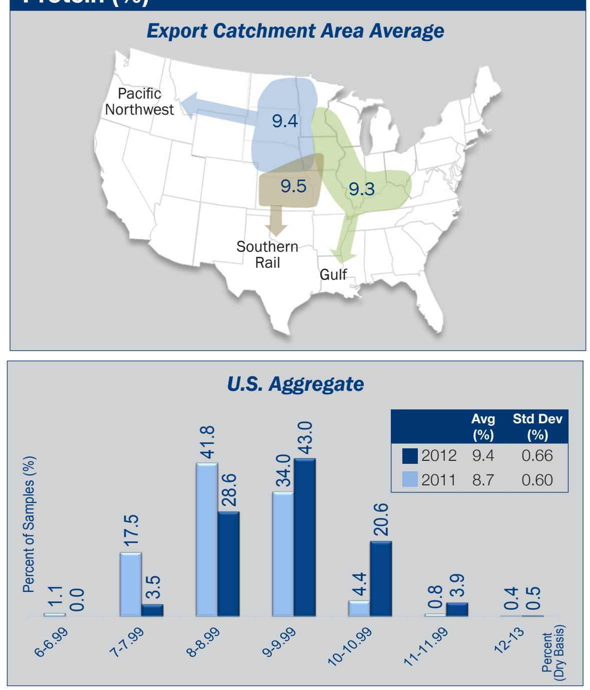
1. Protein

Protein is very important for poultry and livestock feeding. It helps with feeding efficiency and supplies essential sulfur-containing amino acids. Protein is usually inversely related to starch content. Results are reported on a dry basis.

HIGHLIGHTS

- In 2012, the U.S. Aggregate protein averaged 9.4%, which was significantly higher than the 8.7% found in 2011. Protein ranged from 7.0 to 12.4% with a standard deviation of 0.66% for the U.S. Aggregate.
- Protein was distributed with 28.6% between 8.0% and 8.99%, 43.0% between 9.0% and 9.99%, and 25.0% at 10.0% or higher.
- Protein averages for corn expected to be marketed through the Gulf, Pacific Northwest, and Southern Rail ECAs were 9.3%, 9.4%, and 9.5%, respectively.

Protein (%)

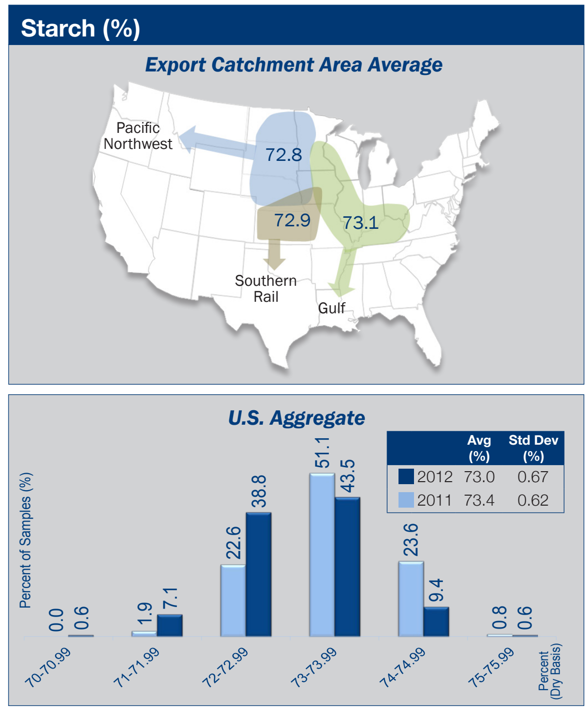


2. Starch

Starch is an important factor for corn used by wet millers and dry-grind ethanol manufacturers. High starch content is often indicative of good kernel maturation/filling conditions and reasonably high kernel densities. Starch is usually inversely related to protein content. Results are reported on a dry basis.

HIGHLIGHTS

- The U.S. Aggregate starch averaged 73.0% in 2012, very close to 73.4% found in 2011.
- Starch ranged from 70.6 to 75.6% with a standard deviation of 0.67% for the U.S. Aggregate.
- Starch was distributed with 38.8% between 72% and 72.99%, 43.5% between 73.0% and 73.99%, and 10.0% equal or greater than 74.0%.
- Starch averages for corn expected to be marketed through the Gulf, Pacific Northwest, and Southern Rail ECAs were 73.1%, 72.8% and 72.9%, respectively.



III. QUALITY TEST RESULTS | 2012 HARVEST

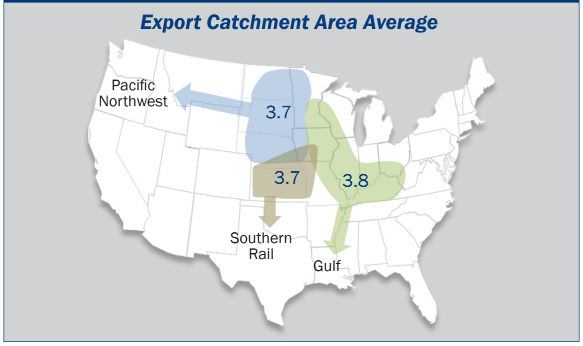
3. Oil

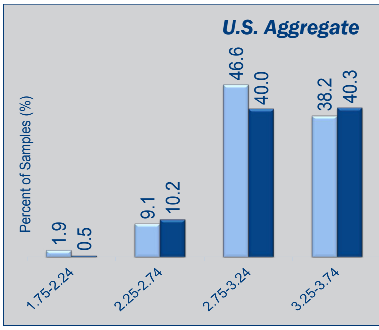
Oil is an essential component of poultry and livestock rations. It serves as an energy source, enables fat-soluble vitamins to be utilized, and provides certain essential fatty acids. Oil is also an important co-product of corn wet and dry milling. Results are reported on a dry basis.

HIGHLIGHTS

- U.S. Aggregate oil averaged 3.7% in 2012, unchanged from the 3.7% found in 2011.
- Oil ranged from 1.7 to 5.5% with a standard deviation of 0.34% for the U.S. Aggregate.
- Oil was distributed with 40.0% of the samples at 2.75 to 3.24%, and 49.1% of samples at 3.25% and higher.
- Oil averages for corn expected to be marketed through the Gulf, Pacific Northwest, and Southern Rail ECAs were 3.8%, 3.7% and 3.7%, respectively. Thus, it is likely that there will be no noteworthy differences in oil content of corn coming from any of these catchment areas.

Oil (%)





	Avg (%)	Std Dev (%)
2012	3.7	0.34
2011	3.7	0.31

SUMMARY: CHEMICAL COMPOSITION

- The significantly higher average protein content (9.4%) in 2012 over 2011 is attributable partly to improved genetics and also to some extent by lowered crop yields (metric tons per hectare or bushels per acre) resulting in increased available nitrogen for surviving plants during the growing season.
- Starch content (73.0%) was moderately high compared to 73.4% in 2011. In combination with observed high test weights, this indicates good kernel filling that should be good for all processing uses and feeding.
- Oil content (3.7 to 3.8%) was relatively constant across all ECAs and unchanged from 2011.

	2012 Harvest					2011 Harvest		
	No. of Samples[1]	Avg.	Std. Dev.	Min.	Max.	No. of Samples[1]	Avg.	Std. Dev.
U.S. Aggregate								
Protein (Dry Basis %)	637	9.4*	0.66	7.0	12.4	474	8.7	0.60
Starch (Dry Basis %)	637	73.0*	0.67	70.6	75.6	474	73.4	0.62
Oil (Dry Basis %)	637	3.7*	0.34	1.7	5.5	474	3.7	0.31
Gulf								
Protein (Dry Basis %)	566	9.3*	0.66	7.0	11.6	364	8.7	0.63
Starch (Dry Basis %)	566	73.1*	0.67	70.6	75.6	364	73.5	0.64
Oil (Dry Basis %)	566	3.8*	0.35	1.7	5.5	364	3.7	0.32
Pacific Northwest								
Protein (Dry Basis %)	321	9.4*	0.67	7.0	12.4	182	8.5	0.52
Starch (Dry Basis %)	321	72.8*	0.66	70.6	75.1	182	73.6	0.56
Oil (Dry Basis %)	321	3.7*	0.31	1.7	4.9	182	3.6	0.26
Southern Rail								
Protein (Dry Basis %)	366	9.5*	0.64	7.0	11.6	149	9.1	0.62
Starch (Dry Basis %)	366	72.9*	0.68	70.6	75.1	149	73.1	0.65
Oil (Dry Basis %)	366	3.7	0.32	1.7	4.9	149	3.7	0.33

** Indicates averages in 2012 were significantly different from 2011 based on a 2-tailed t-test at the 95% level of significance.*

[1]Due to the ECA results being composite statistics, the sum of the sample numbers from the three ECAs is greater than the U.S. Aggregate.

D. Physical Factors

Physical factors are other quality attributes that are neither grading factors nor chemical composition. Tests for physical factors provide additional information about the processing performance of corn for various uses, as well as its storability and potential for breakage in handling. The storability, the ability to withstand handling, and the processing performance of corn are influenced by corn's morphology or parts. Corn kernels are made up of four parts, the germ or embryo, the tip cap, the pericarp or outer covering, and the endosperm. The endosperm represents about 82% of the kernel, and consists of soft (also referred to as floury or opaque) endosperm and of horneous (also called hard or vitreous) endosperm as shown to the right. The endosperm contains primarily starch and protein, the germ contains oil and some proteins, and the pericarp and tip cap are mostly fiber.

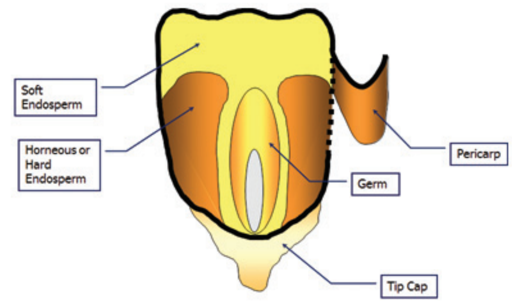


Illustration courtesy of K. D. Rausch University of Illinois

The following tests reflect these intrinsic parts of the corn kernels, in addition to the growing and handling conditions that affect corn quality.

1. Stress Cracks

Stress cracks are internal fissures in the horneous (hard) endosperm of a corn kernel. The pericarp of a stress-cracked kernel is typically not damaged, so the outward appearance of the kernel may appear unaffected at first glance if stress cracks are present.

The cause of stress cracks is pressure buildup due to large moisture gradients and temperature gradients within the kernel's horneous endosperm. This can be likened to the internal cracks that appear when an ice cube is dropped into a lukewarm beverage. The internal stresses cannot build up as much in the soft, floury endosperm as in the horneous endosperm; therefore, corn with a higher percent of horneous endosperm is more susceptible to stress cracking than softer grain with a lower percent of horneous endosperm. A kernel may have one, two, or multiple cracks. High-temperature drying is the most common cause of stress cracks. The impact of high levels of stress cracks on various uses includes:

- General: Increased susceptibility to breakage during handling, leading to increased broken corn needing to be removed during cleaning operations for processors, and possible reduced grade/value.
- Wet Milling: Lower starch yield because the starch and protein are more difficult to separate. Stress cracks may also alter steeping requirements.
- Dry Milling: Lower yield of large flaking grits (the prime product of many dry milling operations).
- Alkaline Cooking: Non-uniform water absorption leading to overcooking or undercooking, which affects the process balance.

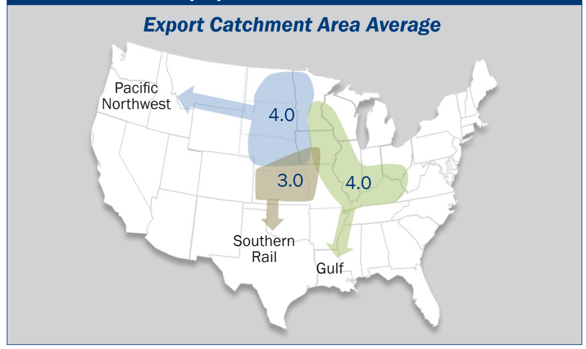
Growing conditions will greatly affect the need for artificial drying and will influence the degree of stress cracking found from region to region. For example, late maturity or late harvest caused by weather-related factors such as rain-delayed planting or cool temperatures may increase the need for artificial drying, thus potentially increasing the occurrence of stress cracks.

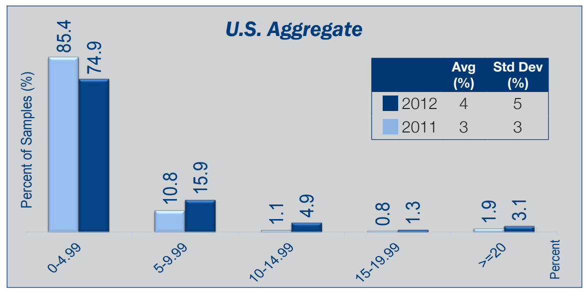
Stress crack measurements include stress cracks (the percent of kernels with at least one crack) and stress crack index (SCI) which is the weighted average of single, double and multiple stress cracks. Stress cracks measure only the number of kernels with stress cracks whereas SCI shows the severity of cracking. For example, if half the kernels have only single stress cracks, stress cracks are 50% and the SCI is 50. However, if all the cracks are multiple stress cracks, indicating a higher potential for handling issues, stress cracks remain at 50% but the SCI becomes 250. Lower values for stress cracks and the SCI are always better. In years with high levels of stress cracks, the SCI is valuable because high SCI numbers (perhaps 300 to 500) indicate the sample had a very high percent of multiple stress cracks. Multiple stress cracks are somewhat more detrimental to quality changes than single stress cracks.

HIGHLIGHTS

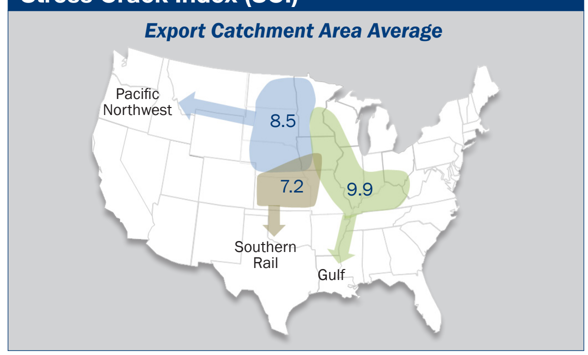
- Stress cracks of U.S Aggregate corn averaged 4% in 2012 (3% in 2011).
- Stress cracks ranged from 0 to 63% with a standard deviation of 5% (3% in 2011).
- Stress cracks distribution showed 90.8% (96.2% in 2011) of samples with less than 10% stress cracks.
- The percent of stress cracks for all regions including the Gulf, Pacific Northwest and Southern Rail ECAs was extremely low averaging only 3 to 4%.
- SCI had a low U.S. Aggregate average of 9.3 (4.6 in 2011) with a range of 0 to 217.
- 95.8% of the samples had an SCI of less than 40, indicating very few kernels had double or multiple stress cracks. This is the normal expectation at the first point of delivery.
- The low levels of stress cracks observed should result in reduced rates of breakage when corn is handled, improved wet milling starch recovery, improved dry milling yields of flaking grits, and good alkaline processing performance.

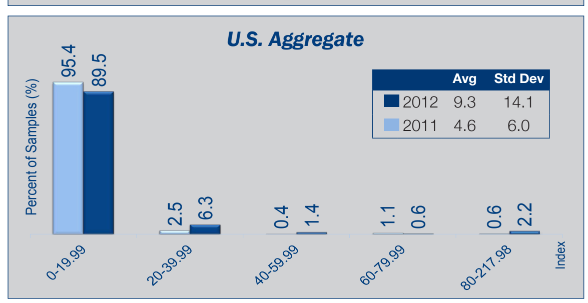
Stress Cracks (%)





Stress Crack Index (SCI)





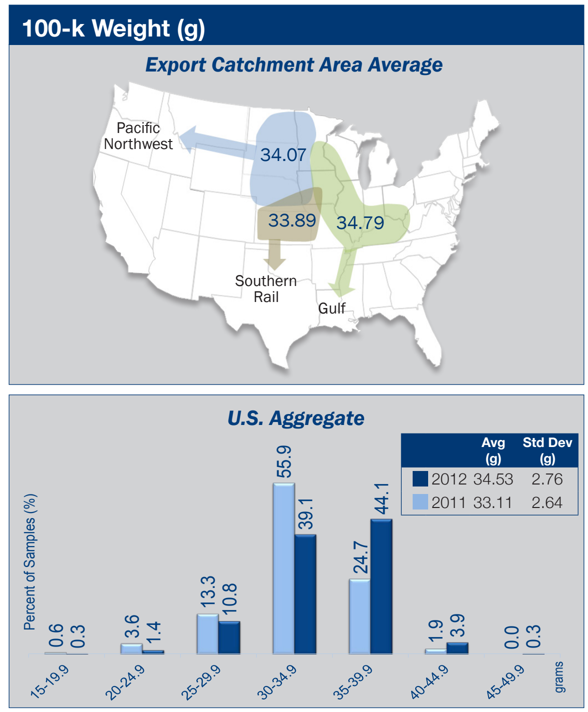
III. QUALITY TEST RESULTS | 2012 HARVEST

2. 100-Kernel Weight

100-kernel (100-k) weight indicates larger kernel size as 100-k weights increase. Large kernels affect drying rates and large uniform-sized kernels often enable higher flaking grit yields in dry milling. Kernel weights tend to be higher for varieties with high amounts of horneous (hard) endosperm.

HIGHLIGHTS

- 100-k weights of U.S. Aggregate corn averaged 34.53 g in 2012, compared to 33.11 g in 2011.
- 100-k weights ranged from 17.49 to 45.39 g. This shows a wide range of kernel sizes was found across all ECAs.
- The 100-k weights were distributed so that 87.4% of the aggregate samples had 100-k weights of 30 g or greater.

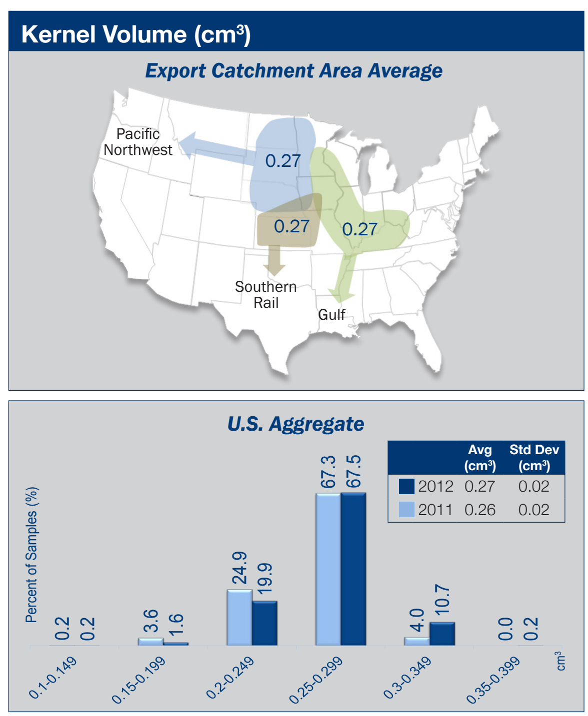


3. Kernel Volume

Kernel volume in cm^3 is often indicative of growing conditions. If conditions are dry, kernels may be smaller than average. If drought hits later in the season, kernels may have lower fill. Small or round kernels are more difficult to degerm. Additionally, small kernels may lead to increased cleanout loss for processors and higher yields of fiber.

HIGHLIGHTS

- Kernel volume averaged 0.27 cm^3 for U.S. Aggregate corn in 2012 which was higher than expected for drought-year corn and even higher than 2011 corn. Kernel volumes ranged from 0.14 to 0.35 cm^3. The higher kernel volumes in 2012 are consistent with the higher 100-k weights which also indicate larger kernels sizes in 2012 than in 2011.
- There was no difference in average kernel volume among ECAs.



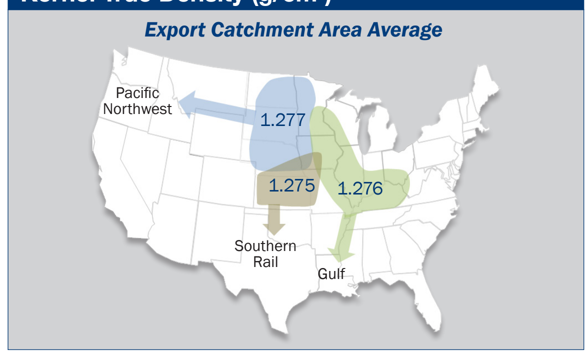
4. Kernel True Density

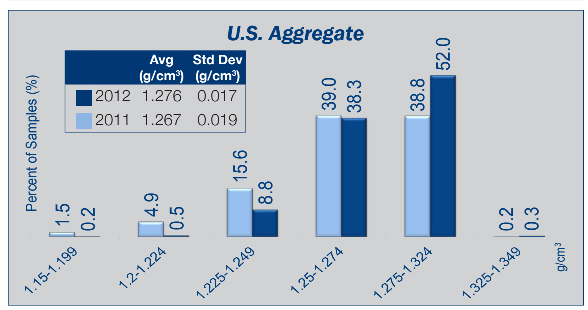
Kernel true density is calculated as the weight of a 100-k sample divided by the volume, or displacement, of those 100 kernels. True density is a relative indicator of kernel hardness, which is useful for alkaline processors and dry millers. True density, as a relative indicator of hardness, may be affected by the genetics of the corn hybrid and the growing environment. Corn with higher density is typically less susceptible to breakage in handling than lower density corn, but it is also more at risk for the development of stress cracks if high-temperature drying is employed. True densities above 1.30 g/cm^3 would indicate very hard corn desirable for dry milling and alkaline processing. True densities near the 1.275 g/cm^3 level and below tend to be softer, but will process well for wet milling and feed use.

HIGHLIGHTS

- Kernel true density averaged 1.276 g/cm^3 for U.S. Aggregate corn in 2012 which is significantly higher than 1.267 g/cm^3 found in 2011. In 2012, true densities ranged from 1.199 to 1.332 g/cm^3.
- Since moistures of samples when tested for true density in 2012 averaged 0.3% points lower than in 2011, a comparison was made for both years after kernel true densities were adjusted to 15.0% moisture. After adjustment to constant moisture, true densities in 2012 averaged 1.271 g/cm^3 and they would have averaged 1.263 g/cm^3 in 2011. Either way, with or without moisture adjustment, the 2012 U.S. Aggregate samples remained 0.009 g/cm^3 higher in density than the samples in 2011.
- Kernel true densities were distributed so that more than 52.3% of the samples were at or over 1.275 g/cm^3 in 2012 compared to only 40.8% of the samples that high in 2011. This would indicate kernels in 2012 tend to have harder endosperm. The harder endosperm and higher true densities in 2012 were consistent with the higher test weights also found in 2012.
- Kernel true density was relatively constant among ECAs (averages between 1.275 to 1.277 g/cm^3).

Kernel True Density (g/cm^3)





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5. Whole Kernels

Though the name suggests some inverse relationship between whole kernels and BCFM, the whole kernels test conveys different information than the broken corn portion of the BCFM test. Broken corn is defined solely by the size of the material. Whole kernels, as the name implies, is the percent of fully intact kernels in the sample.

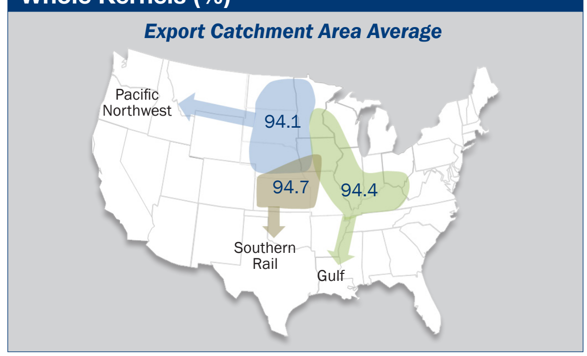
The exterior integrity of the corn kernel is very important for two key reasons. First, if affects water absorption for alkaline cooking operations. Kernel nicks or cracks allow water to enter the kernel faster than intact or whole kernels. Too much water uptake during cooking can result in expensive shutdown time and/or products that do not meet specifications. Some companies even pay extra premiums, over and above contracted premiums, for contracted corn delivered above a specified level of whole kernels.

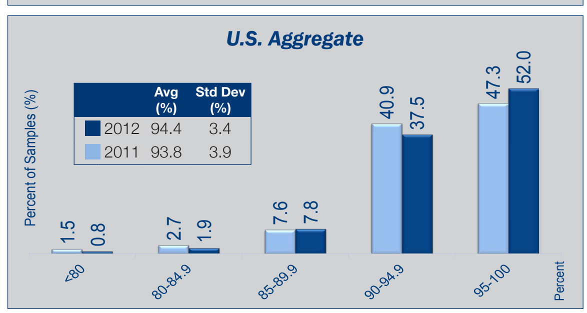
Second, an intact whole kernel is important for all corn that has to be stored or handled. Fully intact whole kernels are less susceptible to storage molds and breakage in handling. While hard endosperm texture lends itself to preservation of more whole kernels than soft corn, the primary factor in delivering whole kernels is handling during and after harvest. This begins with the combine configuration followed by the type, number and length of conveyance required to go from the farm to end user. All subsequent handling will generate additional breakage to some degree. Harvesting at higher moisture contents (e.g., greater that 25%) will usually lead to more damage to grain than harvesting at lower moisture levels (less than 18%).

HIGHLIGHTS

- Percent of whole kernels averaged 94.4% for U.S. Aggregate corn compared to 93.8% in 2011. In 2012, whole kernels ranged from 68.0 to 100.0%.
- 89.5% of the U.S. Aggregate samples had whole kernels equal to or greater than 90%.
- Percent of whole kernel averages for Gulf, Pacific Northwest, and Southern Rail were 94.4%, 94.1%, and 94.7%, respectively.
- Percent of whole kernels was high when farm corn was delivered to local elevators. The high initial percent of whole kernels should reduce storage risk and in combination with the low stress cracks should enable reduced breakage in handling.

Whole Kernels (%)





6. Horneous Endosperm

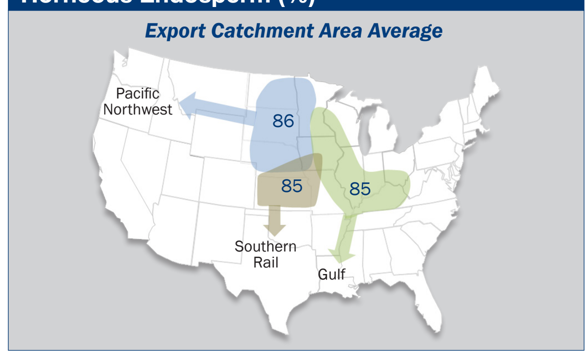
The horneous endosperm test measures the percent of horneous or hard endosperm with a potential value from 70 to 100%. The greater the amount of horneous endosperm relative to soft endosperm, the harder the corn kernel is said to be. The degree of hardness is important depending on the type of processing. Hard corn is needed to produce high yields of large flaking grits in dry milling. Medium-high to medium hardness is desired for alkaline cooking. Moderate to soft hardness is used for wet milling and livestock feeding.

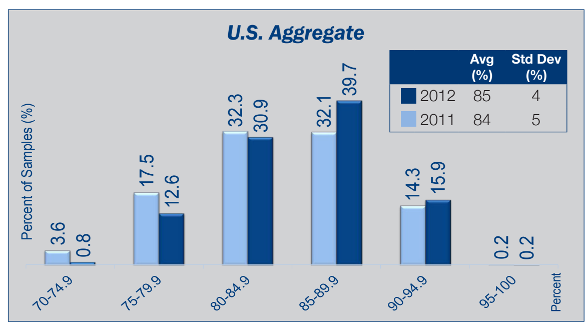
Hardness has been correlated to breakage susceptibility, feed utilization/efficiency and starch digestibility. As a test of overall hardness, there is no good or bad value for horneous endosperm; there is only a preference by different end users for particular ranges. Many dry millers and alkaline cookers would like greater than 90% horneous endosperm, while wet millers and feeders would typically like values between 70% and 85%. However, there are certainly exceptions in user preference.

HIGHLIGHTS

- Horneous endosperm averaged 85% for U.S. Aggregate corn in 2012 compared to 84% in 2011.
- Horneous endosperm ranged from 74 to 97% in 2012 compared to 71 to 95% in 2011. Thus, the higher percentages of hard endosperm found in 2012 are consistent with the higher levels of true density, indicating harder corn in 2012.
- Of the U.S. Aggregate samples, 86.7% resulted in equal to or greater than 80% horneous endosperm in 2012, compared to only 78.9% in 2011.
- Horneous endosperm percentages did not vary substantially across ECAs (averages were 85 to 86%).

Horneous Endosperm (%)





	Avg (%)	Std Dev (%)
2012	85	4
2011	84	5

III. QUALITY TEST RESULTS | 2012 HARVEST

SUMMARY: PHYSICAL FACTORS

- The low levels of stress cracks (4%) should result in a high probability of reduced rates of breakage when corn is handled, improved wet milling starch recovery, improved dry milling yields of flaking grits, and good alkaline processing characteristics. These, however, may be affected by further drying and handling in the marketing channel.
- In spite of a drought year, average kernel volumes and 100-k weights were significantly higher in 2012 than in 2011.
- Kernel true densities were significantly higher in 2012 than in 2011. Similarly, hard endosperm percentages were higher in 2012 than in 2011 indicating a greater prevalence of hard endosperm corn in 2012. The average true density of 1.276 g/cm^3 and the higher kernel volumes should indicate good availability of corn for dry milling and alkaline processing uses, yet it should still be acceptable for wet milling and feeding.
- The relatively high initial whole kernels (94.4%) in combination with the low stress cracks (4%) provide an indication of good storable corn that should also have reduced breakage in handling.

SUMMARY: PHYSICAL FACTORS

	2012 Harvest					2011 Harvest		
	No. of Samples[1]	Avg.	Std. Dev.	Min.	Max.	No. of Samples[1]	Avg.	Std. Dev.
U.S. Aggregate						**U.S. Aggregate**		
Stress Cracks (%)	637	4*	5	0	63	474	3	3
Stress Crack Index[2]	637	9.3*	14.1	0	217	474	4.6	6.0
100-Kernel Weight (g)	637	34.53*	2.76	17.49	45.39	474	33.11	2.64
Kernel Volume (cm^3)	637	0.27*	0.02	0.14	0.35	474	0.26	0.02
True Density (g/cm^3)	637	1.276*	0.017	1.199	1.332	474	1.267	0.019
Whole Kernels (%)	637	94.4*	3.4	68.0	100.0	474	93.8	3.9
Horneous Endosperm (%)	637	85*	4	74	97	474	84	5
Gulf						**Gulf**		
Stress Cracks (%)[2]	566	4*	5	0	63	364	3	3
Stress Crack Index[2]	566	9.9*	15.5	0	217	364	4.6	6.3
100-Kernel Weight (g)	566	34.79*	2.78	17.49	45.39	364	33.66	2.63
Kernel Volume (cm^3)	566	0.27*	0.02	0.14	0.35	364	0.26	0.02
True Density (g/cm^3)	566	1.276*	0.017	1.199	1.332	364	1.271	0.019
Whole Kernels (%)	566	94.4	3.5	68.0	100.0	364	94.0	3.9
Horneous Endosperm (%)	566	85	4	74	97	364	85	5
Pacific Northwest						**Pacific Northwest**		
Stress Cracks (%)[2]	321	4*	4	0	55	182	3	3
Stress Crack Index[2]	321	8.5*	11.5	0	130	182	5.2	6.6
100-Kernel Weight (g)	321	34.07*	2.51	17.49	45.39	182	31.27	2.59
Kernel Volume (cm^3)	321	0.27*	0.02	0.14	0.35	182	0.25	0.02
True Density (g/cm^3)	321	1.277*	0.016	1.199	1.323	182	1.252	0.021
Whole Kernels (%)	321	94.1	3.3	68.0	99.4	182	93.6	3.9
Horneous Endosperm (%)	321	86*	4	74	97	182	84	4
Southern Rail						**Southern Rail**		
Stress Cracks (%)[2]	366	3*	4	0	58	149	2	2
Stress Crack Index[2]	366	7.2*	10.6	0	174	149	2.9	3.0
100-Kernel Weight (g)	366	33.89	3.07	17.49	45.39	149	33.39	2.80
Kernel Volume (cm^3)	366	0.27	0.02	0.14	0.35	149	0.26	0.02
True Density (g/cm^3)	366	1.275	0.016	1.199	1.328	149	1.273	0.017
Whole Kernels (%)	366	94.7*	2.9	68.0	99.6	149	93.2	3.8
Horneous Endosperm (%)	366	85*	4	74	97	149	83	4

** Indicates averages in 2012 were significantly different from 2011 based on a 2-tailed t-test at the 95% level of significance.*

[1]Due to the ECA results being composite statistics, the sum of the sample numbers from the three ECAs is greater than the U.S. Aggregate.

[2]The Relative ME for predicting the Harvest population average exceeded ±10%.

E. Mycotoxins

Mycotoxins are toxic compounds produced by fungi that occur naturally in grains. When consumed at elevated levels, mycotoxins may cause sickness in humans and animals. While several mycotoxins have been found in corn grain, aflatoxins and deoxynivalenol (DON or vomitoxin) are considered to be two of the important mycotoxins.

As in 2011, 2012 harvest samples were tested for aflatoxins and DON for this year's report. Since the production of mycotoxins is heavily influenced by growing conditions, the objective of the *Harvest Quality Reports* is strictly to report on instances when aflatoxins or DON are detected in the corn crop at harvest. No specific levels of the mycotoxins are reported.

The *Harvest Quality Reports* review of mycotoxins is NOT intended to predict the presence or level at which mycotoxins might appear in U.S. corn exports. Due to the multiple stages of the U.S. grain merchandising channel and the laws and regulations guiding the industry, the levels at which mycotoxins appear in corn exports are less than what might first appear in the corn as it comes out of the field. In addition, this report is not meant to imply that this assessment will capture all the instances of mycotoxins across the 12 states or three Export Catchment Areas (ECAs) surveyed. The *Harvest Quality Reports* results should be used only as one indicator of the potential for mycotoxin presence in the corn as the crop comes out of the field. As the Council accumulates several years of the *Harvest Quality Reports*, year-to-year patterns of mycotoxin presence in corn at harvest will be seen. The *U.S. Grains Council Corn Export Cargo Quality Report 2012/13* will report corn quality at export points and will be a more accurate indication of mycotoxin presence in the 2012/13 U.S. corn export shipments.

1. Assessing the Presence of Aflatoxins and DON

To assess the impact of the 2012 growing conditions on total aflatoxins and DON development in the U.S. corn crop, a weighted and systematic testing of at least 25% of the targeted number of 559 samples across the entire sampled area was conducted for both aflatoxins and DON, (see the "Survey and Statistical Analysis Methods" section for details).

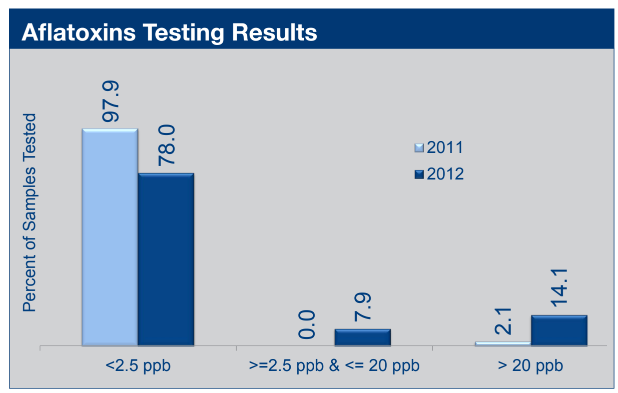
A threshold referred to as the Limit of Detection (LOD) was used to determine whether or not a detectable level of the mycotoxin appeared in the sample. The LOD for the analytical kits used for this report was 2.5 parts per billion (ppb) for aflatoxins and 0.2 parts per million (ppm) for DON. Details on the testing methodology employed in this study for the mycotoxins are in the "Testing Analysis Methods" section.

2. AflatoxinsTesting Results

A total of 177 samples were analyzed for aflatoxins in 2012. This is almost double the number of samples (95) tested for aflatoxins in 2011. Results of the 2012 survey are as follows:

- One hundred thirty-eight, or 78.0%, of the 177 samples had no detectable levels of aflatoxins (above the 2.5 ppb LOD). In 2011, 97.9% of the samples tested had no detectable levels of aflatoxins.
- Fourteen samples, or 7.9%, of the 177 samples showed aflatox in levels greater than or equal to the LOD of 2.5 ppb but less than or equal to the FDA action level of 20 ppb.
- These results denote that 85.9% of the 177 sample test results in 2012 were below or equal to the FDA action level of 20 ppb, compared to 97.9% of the samples tested in 2011.
- Twenty-five, or 14.1%, of the 177 samples tested above the FDA action level of 20 ppb. The 2012 percentage for samples with aflatoxin levels exceeding 20 ppb is greater than the 2.1% observed in 2011.

Comparing the 2012 aflatoxin survey results to the 2011 results suggests that there were more incidents of aflatoxins among all ASDs in 2012 than in the 2011 crop season. The higher proportion of samples with aflatoxin levels exceeding the FDA action level in 2012 than in 2011 may be due, in part, to the lower rainfall amounts and higher temperatures in June through August 2012 compared to similar environmental conditions in 2011 (see the "Crop and Weather Conditions" section for more information on the 2012 growing conditions).

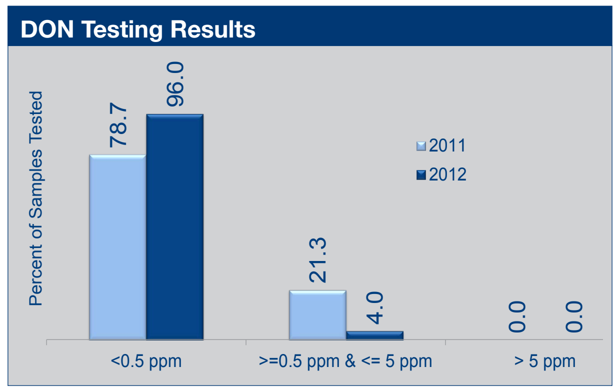


3. DON (Deoxynivalenol or Vomitoxin) Testing Results

A total of 177 samples were analyzed collectively for DON in 2012. This is almost double the number of samples tested (94) in 2011. Results of the 2012 survey are shown below:

- One hundred sixty-eight sample test results, or 94.9% of the 177 samples, had no detectable levels of DON (less than the 0.2 ppm LOD).
- Nine of the 177 samples, or 5.1% of the 177 samples, tested greater than or equal to the LOD of 0.2 ppm, but less than or equal to the FDA advisory level of 5 ppm.
- All 177 samples, or 100%, tested below or equal to the FDA advisory level of 5 ppm.
- The 2012 percentage for samples that tested below 0.5 ppm is higher than the 78.7% observed in 2011, but the 2012 percentage for samples testing at or below 5 ppm is the same as was observed in 2011.

Comparing the 2012 DON survey results to 2011 survey results indicates that there were less DON contaminations in 2012 than in the 2011 crop season. The fact that 96% of all samples in 2012 tested below 0.5 ppm (the 2011 LOD) may be due mainly to weather conditions and specifically to the lower rainfall amounts in June through August 2012 compared to environmental conditions in 2011 (see the "Crop and Weather Conditions" section for more information on the 2012 growing conditions).



4. General Mycotoxin Background

The levels at which the fungi produce the mycotoxins are impacted by the fungus type and the environmental conditions under which the corn is produced and stored. Because of these differences, mycotoxin production varies across the U.S. corn producing areas and across years. In some years, the growing conditions across the corn production regions might not produce elevated levels of any mycotoxins. While in other years, the environmental conditions in a particular area might be conducive to production of a particular mycotoxin to levels that impact the corn's use for human and livestock consumption. Humans and livestock are sensitive to mycotoxins at varying levels. As a result, the U.S. Food and Drug Administration (FDA) has issued action levels for aflatoxins and advisory levels for DON by intended use.

Action levels specify precise limits of contamination above which the agency is prepared to take regulatory action. Action levels are a signal to the industry that FDA believes it has scientific data to support regulatory and/or court action if a toxin or contaminant is present at levels exceeding the action level if the agency chooses to do so. If import or domestic feed supplements are analyzed in accordance with valid methods and found to exceed applicable action levels, they are considered adulterated and may be seized and removed from interstate commerce by FDA.

Advisory levels provide guidance to the industry concerning levels of a substance present in food or feed that are believed by the agency to provide an adequate margin of safety to protect human and animal health. While FDA reserves the right to take regulatory enforcement action, enforcement is not the fundamental purpose of an advisory level.

A source of additional information is the National Grain and Feed Association (NGFA) guidance document titled "FDA Regulatory Guidance for Toxins and Contaminants" found at http://www.ngfa.org/files/misc/Guidance_for_Toxins.pdf.

5. Aflatoxin Background

The most important type of mycotoxin associated with corn grain is aflatoxin. There are several types of aflatoxin produced by different species of Aspergillus with the most prominent species being A. flavus. Growth of the fungus and aflatoxin contamination of grain can occur in the field prior to harvest or in storage. However, contamination prior to harvest is considered to cause most of the problems associated with aflatoxin. A. flavus grows well in hot, dry environmental conditions or where drought occurs over an extended period of time. It can be a serious problem in the southern United States where hot and dry conditions are more common. The fungus usually attacks only a few kernels on the ear and often penetrates kernels through wounds produced by insects. Under drought conditions, it also grows down silks into individual kernels.

There are four types of aflatoxin naturally found in foods – aflatoxins B1, B2, G1 and G2. These four aflatoxins are commonly referred to as “aflatoxins” or “total aflatoxins”. Aflatoxin B1 is the most commonly found aflatoxin in food and feed and is also the most toxic. Research has shown that B1 is a potent naturally occurring carcinogen in animals, with a strong link to human cancer incidence. Additionally, dairy cattle will metabolize aflatoxin to a different form of aflatoxin called aflatoxin M1 which may accumulate in milk.

Aflatoxins are toxic in humans and animals by primarily attacking the liver. The toxicity can occur from short-term consumption of very high doses of aflatoxin-contaminated grain or long-term ingestion of low levels of aflatoxins, possibly resulting in death in poultry and ducks, the most sensitive of the animal species. Livestock may experience reduced feed efficiency or reproduction, and both humans and animals’ immune systems may be suppressed as a result of ingesting aflatoxins.

The FDA has established action levels for aflatoxin M1 in milk intended for human consumption and aflatoxins in human food, grain and livestock feed (see table below).

FDA has established additional policies and legal provisions concerning the blending of corn with levels of aflatoxins exceeding these threshold levels. In general, FDA currently does not permit the blending of corn containing aflatoxin with uncontaminated corn to reduce the aflatoxin content of the resulting mixture to levels acceptable for use as human food or animal feed.

Corn exported from the U.S. must be tested for aflatoxins according to Federal law. Unless the contract exempts this requirement, testing must be conducted by FGIS. Corn above the FDA action level of 20 ppb cannot be exported unless other strict conditions are met. This results in relatively low levels of aflatoxins in exported grain.

Aflatoxins Action Level	Criteria
0.5 ppb (Aflatoxin M1)	Milk intended for human consumption
20 ppb	For corn and other grains intended for immature animals (including immature poultry) and for dairy animals, or when the animal’s destination is not known
20 ppb	For animal feeds, other than corn or cottonseed meal
100 ppb	For corn and other grains intended for breeding beef cattle, breeding swine or mature poultry
200 ppb	For corn and other grains intended for finishing swine of 100 pounds or greater
300 ppb	For corn and other grains intended for finishing (i.e., feedlot) beef cattle and for cottonseed meal intended for beef cattle, swine or poultry

Source: FDA and USDA GIPSA, http://www.gipsa.usda.gov/Publications/fgis/broch/b-aflatox.pdf

6. DON (Deoxynivalenol or Vomitoxin) Background

DON is another mycotoxin of concern to some importers of corn grain. It is produced by certain species of Fusarium, the most important of which is Fusarium graminearum (Gibberella zeae) which also causes Gibberella ear rot (or red ear rot). The fungus can be spotted easily in corn because of the conspicuous red discoloration of kernels on the ear. The presence of Gibberella zeae is mostly a problem when warm, wet weather occurs at flowering. The fungus grows down the silks into the ear, and in addition to producing DON, it results in damage to kernels that is evident during the grain inspection process. DON and Gibberella ear rot are most common in the northern Corn Belt states. This may be due to the susceptibility to the fungus of very early maturing corn hybrids commonly grown in these areas.

DON is mostly a concern with monogastric animals where it may cause irritation of the mouth and throat. As a result, the animals may eventually refuse to eat the DON-contaminated corn and may have low weight gain, diarrhea, lethargy, and intestinal hemorrhaging. It may cause suppression of the immune system resulting in susceptibility to a number of infectious diseases.

The FDA has issued advisory levels for DON. For products containing corn, the advisory levels are:

- 5 ppm in grains and grain co-products for swine, not to exceed 20% of their diet,
- 10 ppm in grains and grain co-products for chickens and cattle, not to exceed 50% of their diet, and
- 5 ppm in grains and grain co-products for all other animals, not to exceed 40% of their diet.

FGIS is not required to test for DON on corn bound for export markets, but will perform either a qualitative or quantitative test for DON at the buyer’s request.

HIGHLIGHTS

Weather plays a large role in corn planting, growing conditions, and grain development, and therefore in final grain yield and quality. Overall, 2012 was a difficult growing year in large portions of the U.S. Corn Belt, with much of the growing area experiencing heat and drought stress. Key events of the 2012 growing season include:

- Record heat and drought throughout much of the growing area reduced overall yield and starch production, while increasing grain protein. However, these conditions did not adversely impact test weight and density.
- Some areas received timely rains (especially Minnesota and North Dakota in the Pacific Northwest and Gulf ECAs), and as a result, had closer to average grain development. Minnesota is projected to have record yields.
- Macroclimate (latitude, temperature, and precipitation), as well as microclimate (within field factors such as low-lying field areas, or relief from the sun due to shading from trees or the land sloping to the north or east) conditions led to great variability in production and quality this year.
- Hybrid selection was a crucial factor for tolerance of the drought and heat.

The following sections describe how the 2012 growing season weather impacted the corn yield and quality in the U.S. Corn Belt.

A. Planting and Early Growth Conditions–Spring (March–May)

Early planting was adversely impacted by cold temperature snaps and no rain

Weather factors impacting corn yield and quality include the amount of precipitation and the temperature just prior to and during the corn growing season. These weather factors interact with the corn variety and the soil fertility to influence final grain yield and quality. Grain yield is a function of the number of plants per acre, the number of kernels per plant, and the weight of each kernel. Cold or wet weather at planting could reduce plant numbers or hinder plant growth, both of which would produce lower yields. Some dryness at planting time is beneficial, as it promotes a deeper root system to access water later in the season. Extreme dryness during the first few weeks of growth, on the other hand, may lead to “rootless” corn in which the plants do not form a fully normal root system and may be vulnerable to heat and moisture stress and nutrient deficiencies later in the growing season, even if conditions subsequently improve.

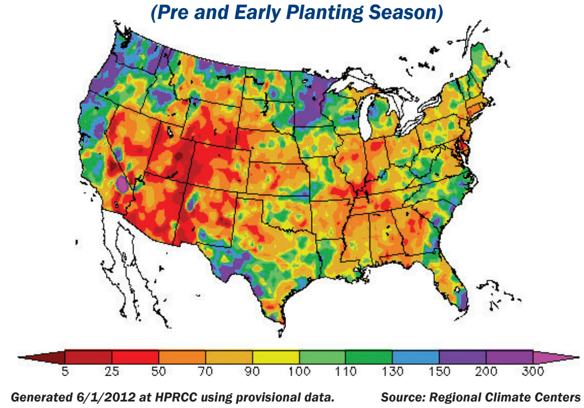
In contrast to 2011 when planting was delayed due to a cool, wet spring, a record-setting warm March and dry spring this year encouraged early planting. Following the early planting, three significant waves of cold air and freezing temperatures (on April 5-7, 11-12, 27) in the Midwest hindered plant growth.

IV. CROP AND WEATHER CONDITIONS | 2012 HARVEST

The warm and dry early spring conditions jump-started the 2012 corn crop. As a result, 96% of the corn was planted by May 21 (15% ahead of the five-year U.S. average), while emergence was at 76% (28% ahead of the five-year U.S. average). Earlier planting is beneficial because farmers want the corn plant to be as large as possible in the long days of June and July.

Unfortunately, however, by the end of May, more than half of the Southern Rail and Gulf ECAs was abnormally dry, setting the stage for this past summer's drought.

Percent of Normal Temperature °F
3/1/2012 - 5/31/2012
(Pre and Early Planting Season)



B. Pollination and Grain Fill Conditions–Summer (June–August)

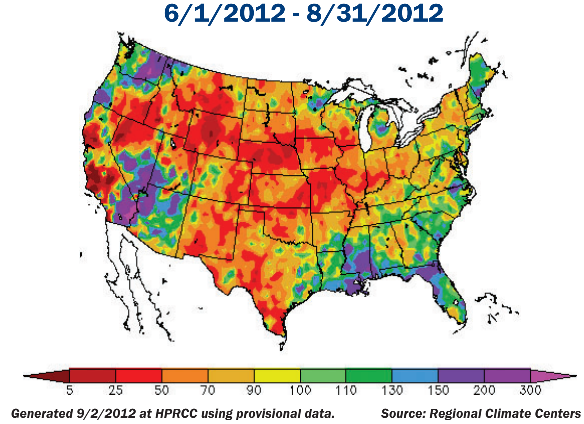
Drought hit the majority of the key corn growing states with some exempt areas

Corn pollination typically occurs in July. At pollination time, greater than average temperatures or lack of rain typically reduces the number of kernels. The weather conditions during the grain filling period in July and August are critical to final grain composition. During this time, moderate rainfall and cooler than average temperatures, especially overnight temperatures, promote starch accumulation and increased yields.

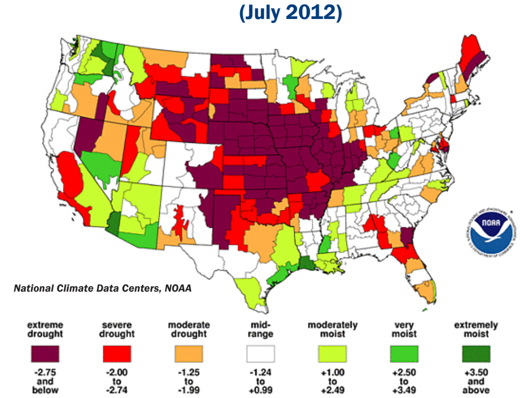
High winds moved through the Midwest at the end of June 2012, possibly affecting the growth of the young corn plants in some fields in the Gulf ECA. Then, the drought rapidly increased in severity from June to July. The percent of cropland experiencing severe or greater drought increased from 20% on June 19 to 51% and 57% by July 17 and August 14, respectively.

The Palmer Z Index is a relative scale indicating how monthly moisture conditions depart from normal, ranging from short-term agricultural drought to extreme wetness. The map indicates dry conditions with red and dark red, while sufficient to excess moisture is indicated by darker shades of green. The July 2012 map of the Palmer Z index shows the wide area of the corn-growing region covered by extreme drought.

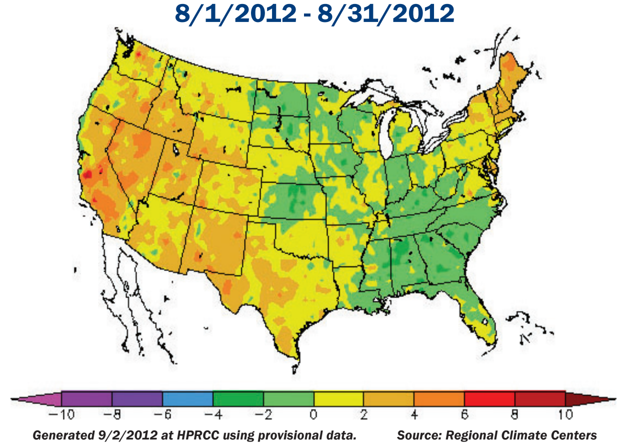
Percent of Normal Precipitation
6/1/2012 - 8/31/2012



Palmer Z Index
Short-Term Conditions
(July 2012)



Percent of Normal Temperature (°F)
8/1/2012 - 8/31/2012



The record heat in June and July, especially during pollination time, and the drought conditions led to less than average yields in the drought stricken areas. It is important to note, however, that those plants which experienced poor pollination and fewer kernels frequently had remaining kernels grow larger and accumulate more protein per kernel than average.

Conversely, Minnesota, Wisconsin, North Dakota, South Dakota, and some areas in Iowa had timely rains in June, which helped moderate the summer stresses, leading to more starch production and yield in those areas. Cooler weather came in August, but by then, the leaves were dying and ceasing photosynthesis, and therefore grain starch accumulation ended. However, some additional grain protein accumulation was still possible due to remobilization of nitrogen from the leaves and stalk to the grain. In some areas, later-planted or re-planted corn escaped the worst of the heat, with the kernels still growing and developing in August, as would happen in an average year.

C. Harvest Conditions (August–October +)

Harvest moved along quickly accompanied by differing crop conditions

At the end of the growing season, drying down of the grain is dependent upon sunshine, temperature, humidity levels, and soil dryness. Corn can most effectively dry down with the least adverse impact on quality with sunny, warm days with low humidity. Another weather concern at the end of the growing season is freezing temperatures. Early freezing before the grain is sufficiently dry leads to decreased test weight, increased cracks, and, therefore, lower quality grain.

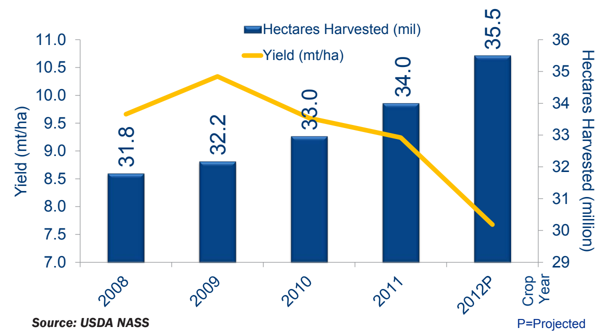
In the areas most affected by the heat and drought, predicted low yields motivated many farmers to harvest whole corn plants early as silage for animal feed. For the drought-stricken fields that were not harvested for silage, several conditions precipitated an earlier than average harvest. The long-term heat in June and July hastened maturity of the corn plant. A warm, sunny August with low humidity combined with dry soil conditions also hastened the maturation process. Finally, in some areas, weakened plant integrity due to the weather stresses affected both the stalk strength and ear attachment.

These concerns, as well as possible concerns about aflatoxins, led many farmers to harvest the corn as soon as possible. These different scenarios created divergent harvest conditions. In some cases, the grain was drying down below 15% leading to concerns about potential ear drop and stalk lodging (or breakage of the stalk below the ear) as well as loss of harvest weight when delivered to the grain elevator. In other areas, farmers harvested grain at high moistures due to the aforementioned aflatoxin issues. While there was an average overall early harvest, typical rain patterns returned in September and delayed harvest in some areas.

A. U.S. Corn Production[1]

1. U.S. Average Production and Yields

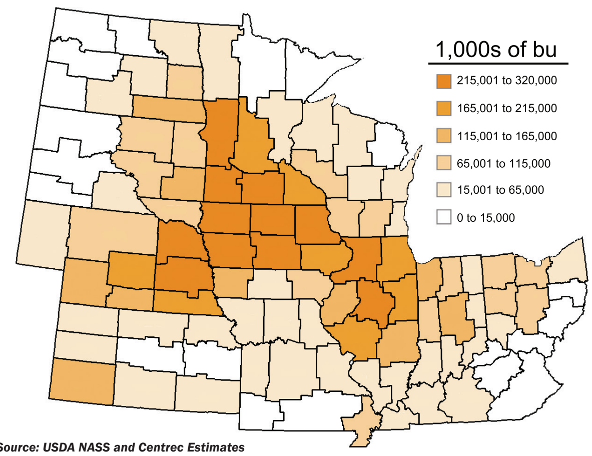
- According to the November 2012 USDA World Agricultural Supply and Demand Estimates (WASDE) report, average U.S. yield for the 2012 crop is projected to be 7.7 mt/ha (122.3 bu/ac). This is 1.5 mt/ha (24.9 bu/ac) lower than the 2011 corn crop and the lowest average yield since 1995.
- The number of hectares harvested in 2012 is projected to be 35.5 million (87.7 mil ac). This is 1.5 mil ha (3.7 mil ac) more than in 2011.
- Total U.S. corn production for 2012 is projected to be 272.4 mmt (10,725 mil bu). This is about 41.5 mmt (1,633 mil bu) lower than 2011, yet still the eighth-largest crop on record.
- The projected lower total production in 2012 was caused by a severe drought and record heat in the key U.S. corn production areas thus driving significantly lower average yield.



[1] mt - metric ton; mmt - million metric tons; ha - hectare; bu - bushel; mil bu - million bushels; ac - acre.

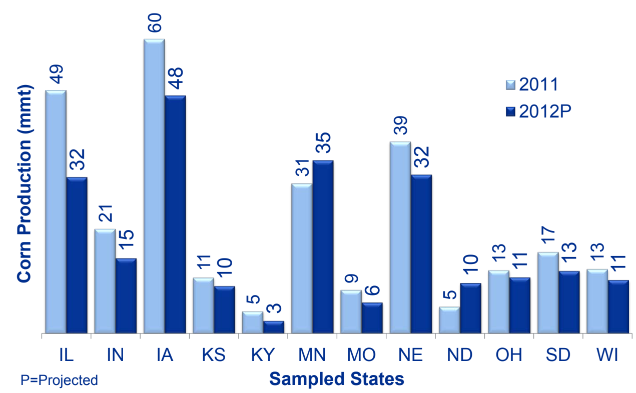
2. ASD and State Level Production

The geographic areas included in the *Harvest Report* encompass the highest corn producing areas in the United States. This can be seen on the map showing estimated 2012 corn production by USDA Agricultural Statistical District (ASD).



Source: USDA NASS and Centrec Estimates

Projected state-level corn production in 2012 differed from 2011 production for the states included in the *Harvest Report* due to generally lower corn yields and/or changed numbers of harvested corn acres.



Source: USDA NASS

The U.S. Corn Production table summarizes the differences in both quantity (mmt) and percentages between 2011 and projected 2012 corn production for each state. Also included is an indication of the relative changes in acres and yield between 2011 and projected 2012. The green bar indicates a relative increase and the red bar indicates a relative decrease from 2011 to projected 2012. This illustrates that acres were largely unchanged to slightly positive, while yield changes were generally negative with the exception of Minnesota and North Dakota.

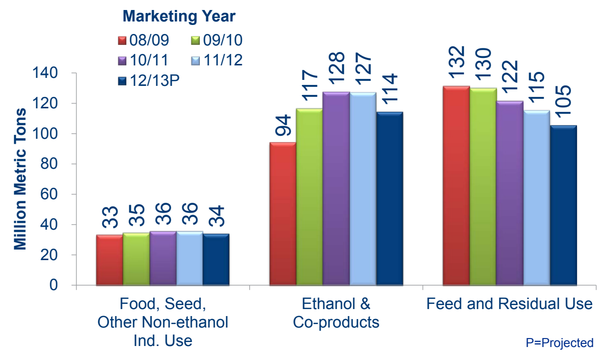
U.S. Corn Production

State	2011	2012P	Difference MMT	Difference Percent	Relative % Change* Acres	Relative % Change* Yield
Illinois	49	32	(18)	-36%		
Indiana	21	15	(6)	-28%		
Iowa	60	48	(11)	-19%		
Kansas	11	10	(2)	-15%		
Kentucky	5	3	(2)	-42%		
Minnesota	31	35	5	15%		
Missouri	9	6	(3)	-28%		
Nebraska	39	32	(7)	-17%		
North Dakota	5	10	5	88%		
Ohio	13	11	(1)	-11%		
South Dakota	17	13	(4)	-23%		
Wisconsin	13	11	(2)	-17%		
Total	273	227	(46)	-17%		

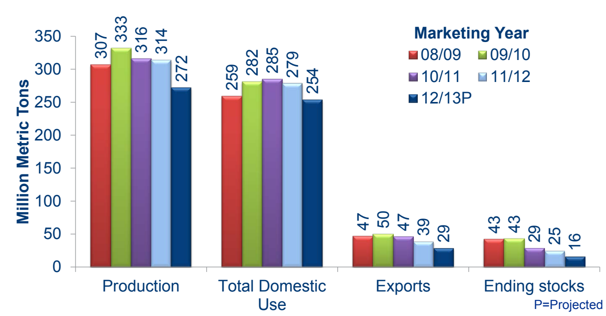
****Green indicates 2012 is higher than 2011 and red indicates 2012 is lower than 2011; bar height indicates the relative amount.***
P=Projected
Source: USDA NASS

B. U.S. Corn Use and Ending Stocks

- U.S. corn use for food, seed and other non-ethanol industrial purposes has remained fairly constant since the 2008/2009 marketing year (MY08/09).
- Corn use for ethanol production has supported overall domestic use in recent years through annual increases from MY06/07 through MY10/11. However, MY11/12 estimated corn use for ethanol is slightly lower than the previous marketing year.
- Direct consumption of corn as a feed ingredient in domestic livestock and poultry rations has continued to decline since MY07/08, in part due to declining meat demand in the United States, tight corn supplies, and record corn prices. However, indirect consumption of corn by livestock and poultry has been rising through increased production and use of distiller's dried grains with solubles (DDGS) (a co-product of ethanol production) in livestock and poultry diets.
- The downward trend in U.S. exports of unprocessed corn has continued since MY09/10. U.S. exports have been hampered by high corn prices due to strong domestic demand, as well as by increased global competition.
- Corn ending stocks in the United States continue their historic lows, a reflection of strong demand exceeding supply.



Source: USDA WASDE and ERS



Source: USDA WASDE and ERS

C. Outlook

1. U.S. Outlook

- The very tight U.S. corn supply for projected MY12/13 is prompting two reactions. The first is increased U.S. corn imports from Brazil and Argentina into the southeast feed market due to the shortage in the Corn Belt. The second is the rationing of domestic corn use and exports through higher prices. This is resulting in a projected overall decline in domestic use of 9% from MY11/12.
- Domestic corn use for livestock and poultry feeding is expected to be about 9% lower in MY12/13 than in MY11/12. This is due primarily to decreasing beef feedlot inventories.
- Corn use for food, seed and non-ethanol industrial (FSI) purposes is expected to be 4 to 5% lower in MY12/13 than in MY11/12. Decreased projected use for high-fructose corn syrup and starch production overshadows the projected increase in other FSI uses.
- While U.S. ethanol production has experienced strong growth over the past few years, corn use for ethanol production in MY12/13 is expected to decline about 10% from the previous year.
- U.S. exports for MY12/13 are projected to decline for the third year in a row, and be about 25% lower than in MY11/12. This is partially due to the continued strength in U.S. corn prices and increased competition from South America and Ukraine, which are increasing exports of corn and feed quality wheat.
- MY12/13 is expected to close with historically tight U.S. ending stocks of around 16.4 mmt as reductions in supply continue to exceed reductions in use.

2. International Outlook

Global Supply

- Corn production outside the United States during MY12/13 is expected to be lower than the record peak set in the previous marketing year, yet it will still be the second highest on record.
- Greater production in countries such as Argentina, South Africa, Mexico and China has largely offset lower production in the United States, Brazil and the Ukraine, compared to the previous marketing year.
- In addition to lower U.S. exports, total non-U.S. exports are also expected to be lower in MY12/13 than in MY11/12.
- Exports from Argentina and South Africa are expected to be higher while exports from Brazil and Former Soviet Union–12 (FSU-12) (including the Ukraine) are expected to be lower in MY12/13.

Global Demand

- Global use is expected to decline around 2% in MY12/13 from MY11/12.
- Year-over-year increases in imports are expected in the European Union-27 (EU-27), Japan, and South Korea, while decreased imports are projected for Egypt, Mexico and Southeast Asia.

V. U.S. CORN PRODUCTION, USAGE AND OUTLOOK | 2012 HARVEST

U.S. CORN SUPPLY AND USAGE SUMMARY BY MARKETING YEAR

Metric Units	08/09	09/10	10/11	11/12	12/13P
Acreage (million hectares)					
Planted	34.8	35.0	35.7	37.2	39.2
Harvested	31.8	32.2	33.0	34.0	35.5
Yield (mt/ha)	9.7	10.3	9.6	9.2	7.7
Supply (million metric tons)					
Beginning stocks	41.3	42.5	43.4	28.6	25.1
Production	307.1	332.6	316.2	313.9	272.4
Imports	0.3	0.2	0.7	0.7	2.5
Total Supply	348.7	375.3	360.2	343.3	300.1
Usage (million metric tons)					
Food, seed, other non-ethanol ind. use	33.4	34.8	35.7	36.2	34.7
Ethanol and co-products	94.2	116.6	127.5	127.3	114.3
Feed and residual	131.6	130.2	121.7	115.5	105.4
Exports	47.0	50.3	46.6	39.2	29.2
Total Use	306.2	331.9	331.6	318.2	283.7
Ending Stocks	42.5	43.4	28.6	25.1	16.4
Average Farm Price ($/mt*)	159.83	139.76	203.93	244.87	273.61 - 324.79

English Units	08/09	09/10	10/11	11/12	12/13P
Acreage (million acres)					
Planted	86.0	86.4	88.2	91.9	96.9
Harvested	78.6	79.5	81.4	84.0	87.7
Yield (bu/ac)	153.9	164.7	152.8	147.2	122.3
Supply (million bushels)					
Beginning stocks	1,624	1,673	1,708	1,128	988
Production	12,092	13,092	12,447	12,358	10,725
Imports	14	8	28	29	100
Total Supply	13,729	14,774	14,182	13,515	11,814
Usage (million bushels)					
Food, seed, other non-ethanol ind. use	1,316	1,370	1,407	1,426	1,367
Ethanol and co-products	3,709	4,591	5,019	5,011	4,500
Feed and residual	5,182	5,125	4,793	4,547	4,150
Exports	1,849	1,980	1,834	1,543	1,150
Total Use	12,056	13,066	13,055	12,527	11,167
Ending Stocks	1,673	1,708	1,128	988	647
Average Farm Price ($/bu*)	4.06	3.55	5.18	6.22	6.95 - 8.25

P-Projected
* Farm prices are weighted averages based on volume of farm shipment.
Average farm price for 12/13P based on WASDE November projected price

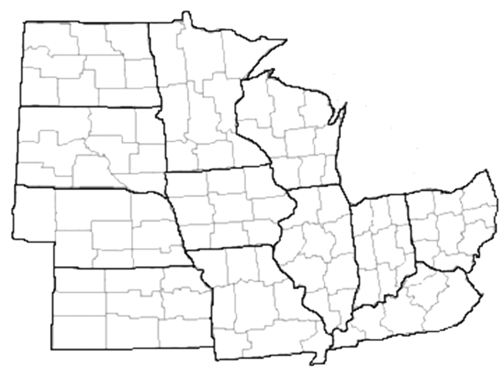
Source: USDA WASDE and ERS

A. Overview

The key points for the survey design and sampling and statistical analysis for this *Harvest Report 2012/13* are as follows:

- Following the methodology developed for the *Harvest Report 2011/12*, the Council proportionately stratified the samples according to Agricultural Statistical Districts (ASDs) across 12 key corn producing states representing 99% of U.S. corn exports.
- A total of 559 samples collected from the 12 states was targeted to achieve a maximum ±10% relative margin of error (Relative ME) at the 95% confidence level.
- A total of 637 unblended corn samples pulled from inbound farm-originated trucks was received from local elevators from September 6 through November 26, 2012, and tested.
- A proportionate stratified sampling technique was used for the mycotoxin testing across the ASDs in the 12 states surveyed for the other quality factors. This sampling resulted in 177 samples being tested for aflatoxins and DON.
- Weighted averages and standard deviations following standard statistical techniques for proportionate stratified sampling were calculated for the U.S. Aggregate and the three Export Catchment Areas (ECAs).
- To evaluate the statistical validity of the samples, the Relative ME was calculated for each of the quality attributes at the U.S. Aggregate and the three ECA levels. The Relative ME for the quality factor results was less than ±10% except for two attributes – stress cracks and stress crack index (SCI). While the lower level of precision for these quality factors is less than desired, these levels of Relative ME do not invalidate the estimates.
- Two-tailed t-tests at the 95% confidence level were calculated to measure statistical differences between the 2011 and the 2012 quality factor averages.

Agricultural Statistical Districts (ASDs)



B. Survey Design and Sampling

1. Survey Design

For this *Harvest Report 2012/13*, the target population was yellow commodity corn from the 12 key U.S. corn producing states representing about 99% of U.S. corn exports. The Council applied a ***proportionate stratified***, ***random sampling*** technique to ensure a sound statistical sampling of the U.S. corn crop at the first stage of the marketing channel. Three key characteristics define the sampling technique: the ***stratification*** of the population to be sampled, the ***sampling proportion*** per stratum, and the ***random sample*** selection procedure.

Stratification involves dividing the survey population of interest into distinct, non-overlapping subpopulations called strata. For this study, the survey population was corn produced in areas likely to export corn to foreign markets. The U.S. Department of Agriculture (USDA) divides each state into several Agricultural Statistical Districts (ASDs) and estimates corn production for each ASD. The USDA corn production data, accompanied by foreign export estimates, were used to define the survey population in 12 key corn producing states representing 99% of U.S. corn exports (Source: USDA/

GIPSA). The ASDs were the subpopulations or strata used for this corn quality survey. From those data, the Council calculated each ASD's proportion of the total production and foreign exports to determine the ***sampling proportion*** (the percent of total samples per ASD) and ultimately, the number of corn samples to be collected from each ASD. The number of samples collected for the *Harvest Report 2012/13* differed from ASD to ASD because of the different shares of estimated production and foreign export levels.

The ***number of samples collected was established*** so the Council could estimate the true averages of the various quality factors with a certain level of precision. The level of precision chosen for the *Harvest Report 2012/13* was a relative margin of error (Relative ME) no greater than ±10%, estimated with a 95% level of confidence. A Relative ME of ±10% is a reasonable target for biological data such as these corn quality factors.

To determine the number of samples for the targeted Relative ME, ideally the population variance (i.e., the variability of the quality factor in the corn at harvest) for each of the quality factors should be used. The more variation among the levels or values of a quality factor, the more samples needed to estimate the true mean with a given confidence limit. In addition, the variances of the quality factors typically differ from one another. As a result, different sample sizes for each of the quality factors would be needed for the same level of precision.

Since the population variances for the seventeen quality factors evaluated for this year's corn crop were not known, the variance estimates from last year's *Harvest Report* were used as proxies. The variances and ultimately the estimated number of samples needed for the Relative ME of ±10% for 14 quality factors were calculated using the 2011 results of 474 samples. Broken corn, foreign material, and heat damage were not examined. Stress crack index (SCI), with a Relative ME of 11.81%, was the only quality factor for which the Relative ME exceeded ±10% for the U.S. Aggregate. Based on these data, a total sample size of 559 would allow the Council to estimate the true averages of the quality characteristics with the desired level of precision for the U.S. Aggregate with the exception of SCI.

The same approach of proportionate stratified sampling was used for the mycotoxin testing of the corn samples as for the testing of the grade, moisture, chemical and physical characteristics. In addition to using the same sampling approach, the same level of precision of a Relative ME of ±10%, estimated with a 95% level of confidence, was desired. Testing at least 25% of the total number of targeted samples (559) was estimated to provide that level of precision. In other words, testing at least 140 samples would provide a 95% confidence level that the percent of tested samples with aflatoxin results below the FDA action level of 20 parts per billion (ppb) would have a Relative ME less than or equal to ±10%. In addition, it was estimated that the percent of tested samples with DON results below the FDA advisory level of 5 parts per million (ppm) would also have a Relative ME less than or equal to ±10%, estimated with a 95% level of confidence.

2. Sampling

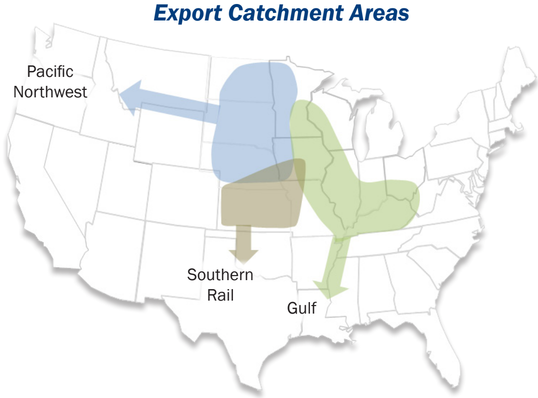
The ***random selection*** process was implemented by soliciting local grain elevators in the 12 states by mail, fax, e-mail and phone. Postage-paid sample kits were mailed to elevators agreeing to provide the 2050 to 2250-gram corn samples requested. Samples were collected from the elevators when at least 30% of the corn in their area had been harvested. The 30% harvest threshold was established to avoid receiving old crop corn samples as farmers cleaned out their bins for the current crop or new crop harvested earlier than normal for reasons such as elevator premium incentives. The individual samples were pulled from inbound farm-originated trucks when the trucks underwent the elevators' normal testing procedures. The number of samples each elevator provided for the survey depended on the targeted number of samples needed from the ASD along with the number of elevators willing to provide samples. A maximum of four samples from each physical location was collected. A total of 637 unblended corn samples pulled from inbound farm-originated trucks were received from local elevators from September 6 through November 26, 2012, and tested.

C. Statistical Analysis

The sample test results for the grade factors, moisture, chemical composition, and physical factors were summarized as the U.S. Aggregate and also by three composite groups that supply corn to each of three major export channels, labeled Export Catchment Areas (ECAs), as follows:

- The Gulf ECA consists of areas that typically export corn through the U.S. Gulf ports;
- The Pacific Northwest (PNW) ECA includes areas that export corn through Pacific Northwest and California ports; and
- The Southern Rail ECA comprises areas generally exporting corn to Mexico.

Export Catchment Areas



In analyzing the sample test results, the Council followed the standard statistical techniques employed for proportionate stratified sampling, including ***weighted averages*** and ***standard deviations***. In addition to the weighted averages and standard deviations for the U.S. Aggregate, weighted averages and standard deviations were estimated for the composite ECAs. The geographic areas from which exports flow to each of these ECAs overlap due to available transportation modes. Therefore, composite statistics for each ECA were calculated based on estimated proportions of grain flowing to each ECA. As a result, corn samples could be reported in more than one ECA. These estimations were based on industry input, export data, and evaluation of studies of grain flow in the United States.

In some instances, the elevator recruiting process resulted in surplus samples in the ASDs. These extra samples were tested to provide greater density in the sampling. However, the U.S. Aggregate and ECA averages were still weighted by the original sampling proportions.

The Relative ME was calculated for each of the quality factors for the U.S. Aggregate and each of the ECAs. The Relative ME was less than ±10% for all the quality attributes except for SCI for the U.S. Aggregate, and stress cracks and SCI for the Gulf, Pacific Northwest and Southern Rail ECAs. The Relative ME for stress cracks and SCI was as follows:

	Relative ME	
	Stress Cracks	SCI
U.S. Aggregate		12%
Gulf ECA	11%	13%
Pacific Northwest ECA	12%	15%
Southern Rail ECA	12%	15%

While the lower level of precision for these quality factors is less than desired, these levels of Relative ME do not invalidate the estimates. A footnote in the summary table for “Physical Factors” indicates the attributes for which the Relative ME exceeds ±10%.

References in the “Quality Test Results” section to statistical differences between 2012 and 2011 test results were validated by two-tailed t-tests at the 95% confidence level. The t-tests were calculated between results in the *Harvest Report 2011/12* and the *Harvest Report 2012/13.*

VII. TESTING ANALYSIS METHODS | 2012 HARVEST

The corn samples (each about 2200 grams) were sent directly from the local grain elevators to the Illinois Crop Improvement Association's Identity Preserved Grain Laboratory (IPG Lab) in Champaign, Illinois. Upon arrival, the samples were dried, if needed, to a suitable moisture content to prevent any subsequent deterioration during the testing period. Next the sample was split into two 1100-gram subsamples using a Boerner divider. The divider splits the complete sample into two while keeping the attributes of the grain sample evenly distributed between the two subsamples. One subsample was delivered to the Champaign-Danville Grain Inspection (CDGI) for grading. CDGI is the official grain inspection service provider for east-central Illinois as designated by USDA's Federal Grain Inspection Service (FGIS). The grade testing procedures were in accordance with FGIS's *Grain Inspection Handbook* and are described in the following section. The other subsample was analyzed at IPG Lab for the chemical composition and other physical factors following either industry norms or well-established procedures in practice for many years. IPG Lab has received accreditation under the ISO/IEC 17025:2005 International Standard.

A. Corn Grading Factors

1. Test Weight

Test weight is a measure of the quantity of grain required to fill a specific volume (Winchester bushel). 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 sides of the test cup. 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).

2. Broken Corn and Foreign Material (BCFM)

Broken corn and foreign material (BCFM) is part of the FGIS Official U.S. Standards for Corn.

This test determines the amount of 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. 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. Foreign material is defined as all material passing through the 6/64th inch round-hole sieve and the coarse non-corn material retained on top of the 12/64th sieve. BCFM is reported as a percentage of the initial sample by weight.

3. Total Damage/Heat Damage

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

A representative working sample of 250 grams of BCFM-free corn is visually examined by a properly trained individual for content of 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), surface mold, 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 properly trained individual visually inspecting a 250-gram sample of BCFM-free corn. Heat damage, if found, is reported separately from total damage.

B. Moisture

The moisture recorded by the elevators' electronic moisture meters at the time of delivery is reported. Electronic moisture meters sense an electrical property of grains called the dielectric constant that varies with moisture. The dielectric constant rises as moisture content rises.

C. Chemical Composition

1. NIR Proximate Analysis – Corn

Proximates are the major components of the grain. For corn, the NIR Proximate Analysis includes oil content, protein content, and starch content (or total starch). This procedure is nondestructive to the corn.

Chemical composition tests for protein, oil, and starch were conducted using a 400 to 450-gram sample in a whole-kernel Foss Infratec 1229 Near-Infrared Transmittance (NIT) instrument. The NIT was calibrated to chemical tests, and the standard error of predictions for protein, oil, and starch were about 0.2%, 0.3%, and 0.5%, respectively. Results are reported on a dry matter basis (percent of non-water material).

D. Physical Factors

1. 100-Kernel Weight, Kernel Volume and Kernel True Density

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 mg. The averaged 100-kernel weight is reported in grams.

The kernel volume for each 100-kernel replicate is calculated using a helium pycnometer and is expressed in cm^3/kernel. Kernel volumes usually range from 0.18-0.30 cm^3 per kernel for small and large kernels, respectively.

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 1.16 to 1.35 g/cm^3 at "as is" moistures of about 12 to 15%.

2. Stress Crack Analysis

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 the severity of the stress crack damage in each kernel can be evaluated. Kernels are sorted into four categories: (1) no cracks; (2) 1 crack; (3) 2 cracks; and (4) more than 2 cracks. Stress cracks, expressed as a percent, are all kernels containing one, two or more than two cracks divided by 100 kernels. Lower levels of stress cracks are always better since higher levels of stress cracks lead to more breakage in handling. If stress cracks are present, singles are better than doubles or multiples. Some corn end users will specify the acceptable level of cracks based on the intended use.

Stress crack index (SCI) is a weighted average of the stress cracks. This measurement indicates the severity of stress cracking. SCI is calculated as

$$SCI = [SSC \times 1] + [DSC \times 3] + [MSC \times 5]$$

Where

- SSC is the percentage of kernels with only one crack,
- DSC is the percentage of kernels with exactly two cracks, and
- MSC is the percentage of kernels with more than two cracks.

The SCI can range from 0 to 500, with a high number indicating numerous multiple stress cracks in a sample, which is undesirable for most uses.

3. Whole Kernels

In the whole kernels test, 50 grams of cleaned (BCFM-free) corn are inspected kernel by kernel. Cracked, broken, or chipped grain, along with any kernels showing significant pericarp damage are removed, the whole kernels are 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 kernels score of 97% equates to a cracked & broken rating of 3%.

4. Horneous Endosperm

The horneous (or hard) endosperm test is performed by visually rating 20 externally sound kernels, placed germ facing up, on a light table. Each kernel is rated for the estimated portion of the kernel's total endosperm that is horneous endosperm. Soft endosperm is opaque and will block light, while 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 70-100%, though most individual kernels fall in the 70-95% range.

E. Mycotoxin Testing

Detection of mycotoxins in corn is complex. The fungi producing the mycotoxins often do not grow uniformly in a field or across a geographic area. As a result, the detection of any mycotoxin in corn, if present, is highly dependent upon the concentration and distribution of the mycotoxin in a lot of corn, whether a truck load, a storage bin or a rail car.

FGIS's protocol requires a minimum of a 4540-gram (10-pound) sample from large lots such as barges/sublots and a minimum of a 908-gram (2-pound) sample from trucks to grind for aflatoxin testing. The large sample size for large lots is used so the quantitative testing reflects the average mycotoxin concentration of the entire lot of corn in parts per billion (ppb). The objective of the FGIS sampling process is to minimize underestimating or overestimating the true mycotoxin concentration since accurate results are imperative for corn exports. However, the objective of the *Harvest Report 2012/13* assessment of aflatoxins is only to report the frequency of occurrences of the mycotoxin in the current crop, but not specific levels of the mycotoxin in corn exports. It was not feasible to collect 4540 grams per sample for the *Harvest Report 2012/13* aflatoxins testing, so a smaller sample size was used. Using a smaller sample size for testing for aflatoxins increases the potential for overestimating or underestimating the specific level of aflatoxins in the lot. However, only the number and percentage of sample test results above several specified thresholds are being reported.

For this study, a 1000-gram laboratory sample was subdivided from the 2-kg survey sample of shelled kernels for the aflatoxin analysis. The 1-kg survey sample was ground in a Romer Model 2A mill so that 60-75% would pass a 20 mesh screen. From this well-mixed ground material, a 50-gram test portion was removed for each mycotoxin tested. EnviroLogix AQ 109 BG and AQ 204 BG test kits were used for the analysis. The DON was extracted with water (5:1), while the aflatoxins were extracted with 50% ethanol (2:1). The extracts were tested using the Envirologix QuickTox lateral flow strips, and the mycotoxins were quantified by the QuickScan system.

A letter of performance has been issued by FGIS for the quantification of aflatoxins and DON using the Envirologix AQ 109 BG and AQ 204 BG kits, respectively.

VIII. U.S. CORN GRADES AND CONVERSIONS | 2012 HARVEST

CORN GRADES AND GRADE REQUIREMENTS

		Maximum Limits of		
		Damaged Kernels		
Grade	Minimum Test Weight per Bushel (Pounds)	Heat Damaged (Percent)	Total (Percent)	Broken Corn and Foreign Material (Percent)
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

U.S. Sample Grade is corn that: (a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4, or 5; or (b) Contains stones with an aggregate weight in excess of 0.1 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (Crotalaria spp.), 2 or more castor beans (Ricinus communis L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cocklebures (Xanthium spp.), or similar seeds singly or in combination, or animal filth in excess of 0.20 percent in 1,000 grams; or (c) Has a musty, sour, or commercially objectionable foreign odor; or (d) Is heating or otherwise of distinctly low quality.

Source: Code of Federal Regulations, Title 7, Part 810, Subpart D, United States Standards for Corn

U.S. AND METRIC CONVERSIONS

Corn Equivalents		Metric Equivalents	
1 bushel =	56 pounds (25.40 kilograms)	1 pound =	0.4536 kg
39.368 bushels =	1 metric ton	1 hundredweight =	100 pounds or 45.36 kg
15.93 bushels/acre =	1 metric ton/hectare	1 metric ton =	2204.6 lbs
1 bushel/acre =	62.77 kilograms/hectare	1 metric ton =	1000 kg
1 bushel/acre =	0.6277 quintals/hectare	1 metric ton =	10 quintals
56 lbs/bushel =	72.08 kg/hectoliter	1 quintal =	100 kg
		1 hectare =	2.47 acres

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