U.S. Grains Council
Corn Harvest Quality Report
2011/12

U.S. GRAINS COUNCIL

Acknowledgements

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 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. Don White, Lowell Hill, Marvin Paulsen, and Fred Below, and the Illinois Crop Improvement Association's Identity Preserved Grain Laboratory (IPGL).

Finally, this report would not be possible without the thoughtful and timely participation by country 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

U.S. GRAINS COUNCIL

The U.S. Grains Council is pleased to present the inaugural 2011 U.S. Corn Quality Harvest Report. 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 the availability of reliable, timely, and accessible 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 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 harvest 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 negotiate actively 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 initial harvest as an aid to these further discussions.

As the first in an annual series, the 2011 Report establishes 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,

Wendell Shauman, Chairman
U.S. Grains Council
January 2012

Harvest Report Highlights

The 2011 corn crop is entering the marketing channel with the following characteristics.

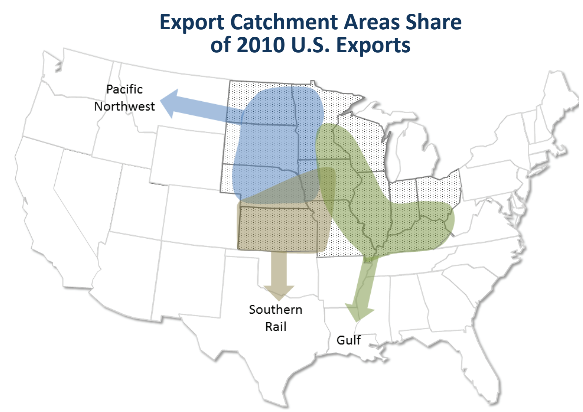
- Good test weight (58.1 lb/bu or 74.8 kg/hl) indicating well filled kernels
- Elevator sample moisture testing at a 15.6% average accompanied by low variability, implying that the corn field dried well and possibly a year for good storability and less drying required overall
- Low total damage (1.1%) with no reported heat damage
- High proportion of whole kernels (93.8%), along with low levels of BCFM (1.0%), possibly reducing storage risk
- Low stress cracks (3%), implying the possibility of reduced rates of breakage as corn is handled, good wet milling starch recovery and dry milling yields of flaking grits, and good alkaline processing
- Relative to protein levels reported in recent years, high U.S. Aggregate average protein concentration of 8.7% (dry basis)
- U.S. Aggregate average starch levels of 73.4% (dry basis), indicating relatively good kernel filling and maturation, results beneficial for wet millers
- Oil content averaging 3.7% (dry basis)
- U.S. Aggregate average true densities in a medium range, which should be good for wet milling and feeding, while samples with high true density levels indicate availability of corn well suited for dry milling and alkaline processing

Survey Overview

The 2011 U.S. Corn Quality Harvest Report has been designed to help foreign U.S. corn buyers understand the initial quality of U.S. yellow commodity corn as it enters the merchandising channel. 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. 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 condition of the corn changes from the point of first sale to the export elevator. For this reason, the Harvest Report should be studied carefully in tandem with the Export Cargo Report that will follow in February 2012.

This is the first of what we intend to be an annual survey of the quality of the U.S. corn crop at harvest. By itself, and without the ability to compare the 2011 results with past years, this report should be interpreted with caution. However, this year's report will establish a benchmark for comparison of subsequent corn crops. As we accumulate these reports over several years, the Harvest Report will gain increased value by enabling export buyers to see patterns of corn quality based on growing conditions across the years.

Even though this year's quality results cannot be compared directly to results from previous years, we are able to draw some baseline conclusions about the initial quality of the 2011 corn crop based on our years of experience in observing corn quality. Despite the challenging growing conditions experienced by many of the U.S. corn production regions during the 2011 growing season, the U. S. produced a favorable quality corn crop. The findings of our quality review of official grade and non-grade factors are summarized in the Executive Overview and detailed in the following sections.



This Harvest Report is based on 474 yellow commodity corn samples taken from areas within twelve of the top corn producing and exporting states. Inbound samples were collected from country grain elevators to assess corn quality at the point of origin, and to provide the most representative information about the variability of the quality characteristics across the diverse geographic regions.

The sample test results are reported at the U.S. aggregate level (U.S. Aggregate). In addition, the sampling areas in the twelve states are divided into three general groupings that we label 'Export Catchment Areas' (ECAs). These three ECAs are identified by the three major pathways to export markets:

a) The Gulf ECA consisting of areas that typically export through the U.S. Gulf ports,

b) The Pacific Northwest (PNW) ECA that includes areas exporting corn through Pacific Northwest and California ports, and

c) The Southern Rail ECA comprising of areas generally exporting corn by rail to Mexico.

Details of the sampling and statistical analysis methods are presented in the "Survey and Statistical Analysis Methods" section.

2011 U. S. Corn Quality Harvest Report Project Team

Corn Quality Overview (2011 Harvest)

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Grade Factors

The U.S. Department of Agriculture's Grain Inspection, Packers and Stockyards Administration (USDA/GIPSA) has established grades, definitions and standards for measurement of many quality factors. The attributes which determine numerical grade are Test Weight, Heat Damage, Total Damage, and Broken Corn and Foreign Material (BCFM). The Corn Grades and Grade Requirements are summarized in the Grade Requirements and Conversions section on page 30. Moisture content is reported on official grade certificates, but does not determine which numerical grade will be assigned to the sample.

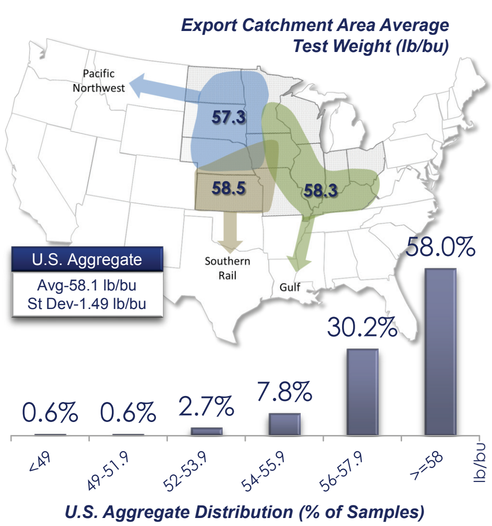
Test Weight

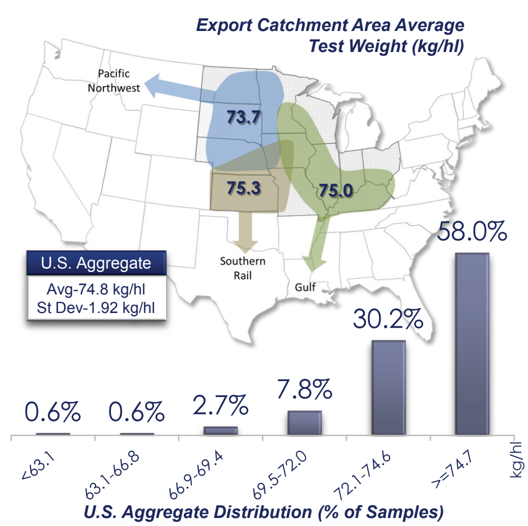
Test Weight (weight per volume) is a measure of bulk density and is often used as a general indicator of overall quality and as a gauge of endosperm hardness to alkaline cookers and dry millers. High test weight corn will take up less storage space than the same weight of corn with a lower test weight. 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

- Average test weight of the U.S. Aggregate of 58.1 lb/bu (74.8 kg/hl) indicates overall good quality and is 4 pounds/bu above the grade limit for No. 2 corn (54 lbs).
- Test weight values in the three ECAs did not vary greatly from the U.S. Aggregate average.
- As corn is comingled moving through the marketing channel, the average test weight in each ECA indicates the U.S. No. 2 minimum for test weight would be met in all ECAs.
- More than 96% of the samples were above the factor limit for No. 2 grade, and over 98% exceeded the factor limit for No. 3 grade (52 lbs).

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





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Corn Quality Overview (2011 Harvest)

Broken Corn and Foreign Material (BCFM)

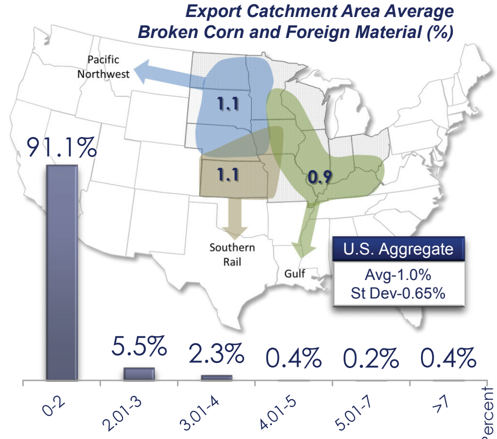
Broken corn and foreign material (BCFM) is an indicator of the amount of clean, sound corn available for feed and processing. The lower the percentage of BCFM, the less foreign material and/or fewer broken kernels in a sample.

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

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

Broken Corn (BC) is defined as everything small enough to pass through a 12/64th inch sieve, but too large to pass through a 6/64th inch sieve. Higher levels of BCFM in farm-originated samples generally stem from combine settings and/or weed seeds in the field.

Export Catchment Area Average Broken Corn and Foreign Material (%)



U.S. Aggregate Distribution (% of Samples)

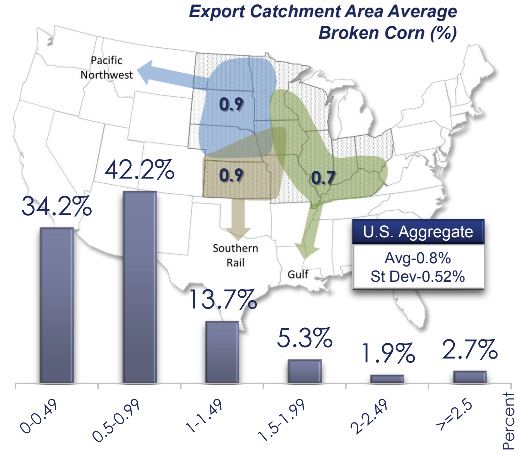
Highlights

- *Average BCFM for the U.S. Aggregate was 1.0%. None of the ECAs differed substantially from the U.S. Aggregate.*
- *BCFM levels in almost all corn delivered to the country elevators are well below the maximum of 3% allowed for No. 2 corn – the basis for most discounts in commercial transactions.*
- *These levels will normally increase during drying and handling, depending on the methods used and the soundness of the kernels.*
- *The U.S. Aggregate samples showed that the 1.0% BCFM contained 0.8% broken corn and 0.2% foreign material.*

Broken Corn (BC)

Broken corn (BC) 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.

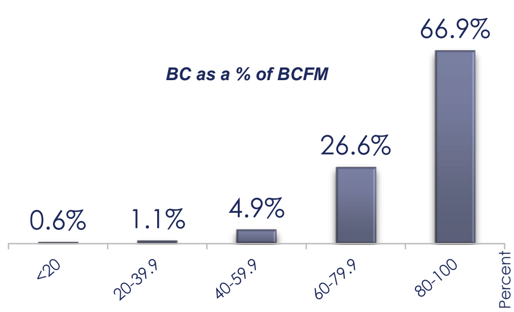
Export Catchment Area Average Broken Corn (%)



U.S. Aggregate Distribution (% of Samples)

Highlights

- *BC averaged 0.8% in the U.S. Aggregate and 0.7% to 0.9% in the individual ECAs.*
- *The percent of BC was lowest in the Gulf ECA, in part as a result of harvesting at slightly higher moisture content.*
- *The levels of BC in farm deliveries in all the areas were very low and would not be an issue in handling and processing.*
- *The distribution chart as shown to the right, displaying BC as a percent of BCFM, shows that in nearly all samples, BCFM consisted primarily of broken corn.*

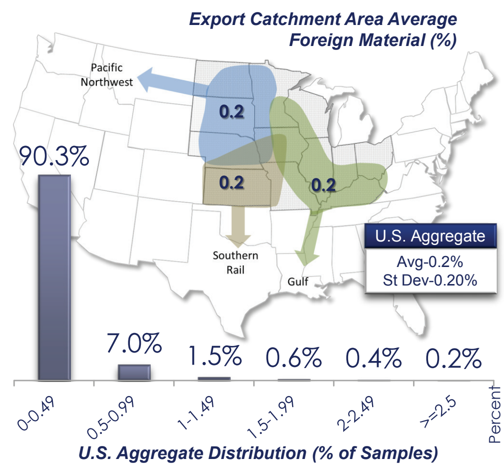


U.S. Aggregate Distribution (% of Samples)

Corn Quality Overview
(2011 Harvest)

Foreign Material (FM)

Foreign Material (FM) 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. FM also contributes to the spoutline and is more serious than BC because of the higher moisture level as mentioned above.



Highlights

- *FM levels below 0.5% seldom create handling problems.*
- *All ECAs had average FM values of 0.2%.*
- *High levels of FM found in a few of the samples can be readily cleaned to minimize any significant handling problems.*

Total Damage

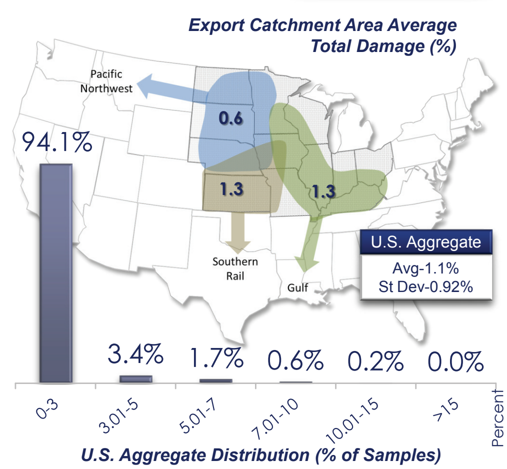
Total damaged kernels is the percentage of kernels and pieces of kernels that are visually damaged in some way, including heat damaged, frost-damaged, insect-bored, sprout-damaged, diseased, weather-damaged, ground-damaged, germ-damaged, and mold-damaged. Most of these types of damage result in some 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 Maximum 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

- *The average levels in all of the ECAs are well below the limit for No. 1 corn (3.0%) and indicate that Total Damage is not a problem in farm deliveries.*
- *The distribution chart shows that 94.1% of the samples had 3% or less damaged kernels.*
- *97.5% of the samples would grade No.2 (5.0%) or better on the factor of Total Damage.*



Heat Damage (HD)

Heat damage (HD) 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. HD is seldom present in corn delivered at harvest direct from farms and combines.

Highlights

- *There was no heat damage reported in any of the samples.*
- *The low heat damage was likely in part due to fresh samples coming directly from farm to elevator with minimal prior drying.*

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

Corn Quality Overview (2011 Harvest)

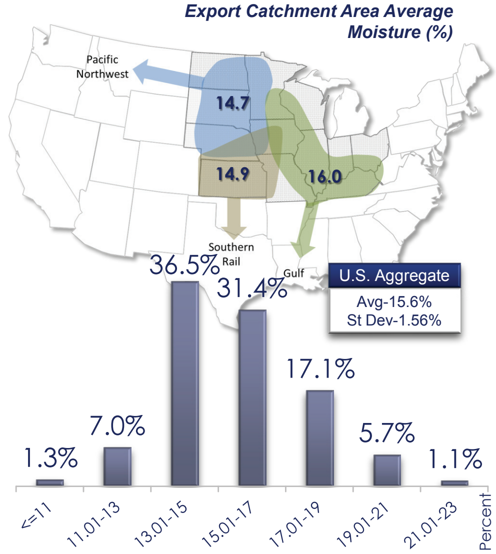
Moisture

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.

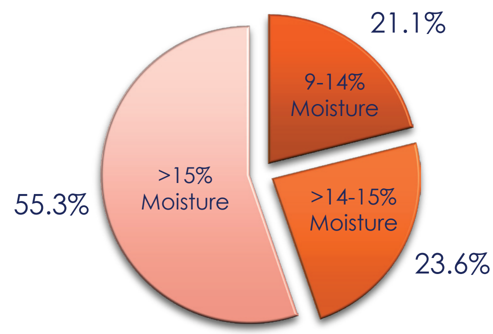
Highlights

- *The U.S. Aggregate elevator-recorded moisture averaged 15.6% with a minimum of 9.5% and a high of 22.0%[1].*
- *44.8% of the samples contained 15% or less moisture – the base used by most elevators for discounts and a level considered storable for short periods.*
- *Moisture averages for corn for the Gulf, Pacific Northwest, and Southern Rail ECAs were 16.0%, 14.7% and 14.9%, respectively; however, minimum and maximum values were similar across the ECAs.*
- *The 1.3% of the samples with very low moisture (≤ 11%) was associated with regions which suffered from drought.*
- *As shown to the right, 21.1% of the samples at the point of delivery to the elevator were already 14 % or less, generally considered a safe level for storage and transport without drying.*

Export Catchment Area Average Moisture (%)



U.S. Aggregate Distribution (% of Samples)



U.S. Aggregate Distribution (% of Samples)

1 The elevators were requested to submit samples only with up to 22% moisture to prevent sample deterioration during shipping (not all samples were mailed to the lab immediately upon collection). While this has the potential to skew the distribution of moisture results slightly, the distribution of this year's crop indicates that the 2011 corn crop, as it was harvested, was not high in moisture.

Corn Quality Overview (2011 Harvest)

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Grade Factors And Moisture Summary

Highlights

- *Test weight was high with U.S. Aggregate samples averaging 58.1 lb/bu (74.8 kg/hl).*
- *BCFM of incoming corn was very low with a U.S. Aggregate average of 1.0%, consisting primarily of broken corn.*
- *Average total damage was extremely low for incoming corn, ranging from 0.6% to 1.3% among ECAs. In addition, no heat damage was reported on any of the samples.*
- *Of the in-bound elevator samples, 90.9% would grade 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 lower.*
- *The U.S. Aggregate elevator-recorded moisture averaged 15.6% with about 45% of the samples containing 15% or less moisture. These results imply that producers were able to take advantage of in-field drying, resulting in less artificial drying and increasing the overall quality of the 2011 corn crop.*

Grade Factors Summary

	No. Samples	Average	Std. Dev.	Minimum	Maximum
U.S. Aggregate					
Test Weight (lb/bu)	474	58.1	1.49	46.0	62.1
Test Weight (kg/hl)	474	74.8	1.92	59.2	79.9
BCFM (%)	474	1.0	0.65	0.0	12.1
Broken Corn (%)	474	0.8	0.52	0.0	10.1
Foreign Material (%)	474	0.2	0.20	0.0	3.0
Total Damage (%)	474	1.1	0.92	0.0	12.0
Heat Damage (%)	474	0.0	0.00	0.0	0.0
Moisture (%)	474	15.6	1.56	9.5	22.0
Gulf					
Test Weight (lb/bu)	364	58.3	1.48	46.0	62.1
Test Weight (kg/hl)	364	75.0	1.91	59.2	79.9
BCFM (%)	364	0.9	0.62	0.0	12.1
Broken Corn (%)	364	0.7	0.49	0.0	10.1
Foreign Material (%)	364	0.2	0.19	0.0	3.0
Total Damage (%)	364	1.3	1.09	0.0	12.0
Heat Damage (%)	364	0.0	0.00	0.0	0.0
Moisture (%)	364	16.0	1.67	9.5	22.0
Pacific Northwest					
Test Weight (lb/bu)	182	57.3	1.57	50.7	61.7
Test Weight (kg/hl)	182	73.7	2.03	65.3	79.4
BCFM (%)	182	1.1	0.75	0.1	4.6
Broken Corn (%)	182	0.9	0.58	0.1	3.6
Foreign Material (%)	182	0.2	0.23	0.0	1.5
Total Damage (%)	182	0.6	0.36	0.0	5.3
Heat Damage (%)	182	0.0	0.00	0.0	0.0
Moisture (%)	182	14.7	1.28	11.7	19.6
Southern Rail					
Test Weight (lb/bu)	149	58.5	1.39	46.0	61.7
Test Weight (kg/hl)	149	75.3	1.79	59.2	79.4
BCFM (%)	149	1.1	0.67	0.0	12.1
Broken Corn (%)	149	0.9	0.53	0.0	10.1
Foreign Material (%)	149	0.2	0.18	0.0	2.1
Total Damage (%)	149	1.3	0.90	0.0	5.6
Heat Damage (%)	149	0.0	0.00	0.0	0.0
Moisture (%)	149	14.9	1.42	9.5	20.2

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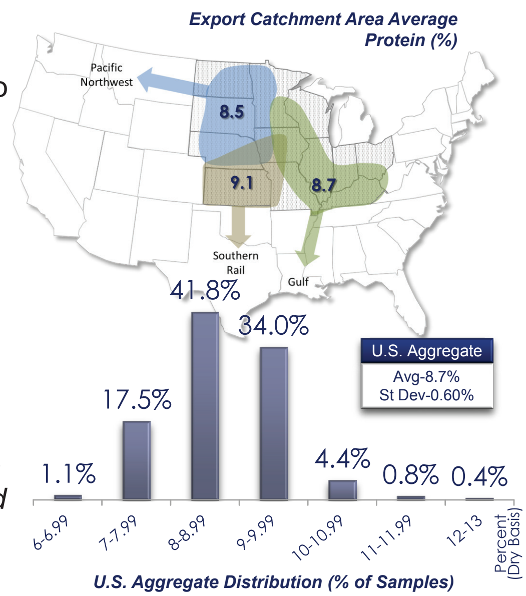
Corn Quality Overview (2011 Harvest)

Chemical Composition

Chemical composition is not a grade factor but it provides additional information related to nutritional value for livestock and poultry feeding and for wet milling uses, as well as other processing uses of corn. Unlike many physical attributes, chemical composition values would not be expected to change significantly during storage or transport. Corn consists primarily of protein, starch and oil, composition components that are of significant interest to the industry.

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.

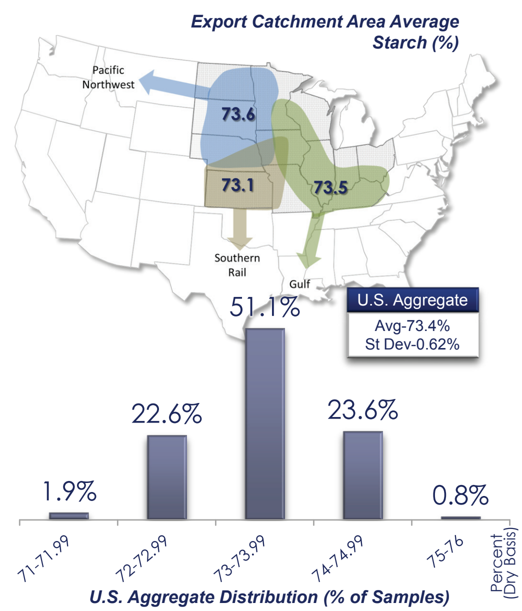


Highlights

- *In 2011, the U.S. Aggregate protein averaged 8.7%.*
- *Protein ranged from 6.7% to 12.5% with a standard deviation of 0.60% for U.S. Aggregate.*
- *Protein was distributed with 41.8% between 8.0% to 8.99% and 34.0% between 9.0% to 9.99%.*
- *Protein averages for corn expected to go to the Gulf, Pacific Northwest, and Southern Rail regions were 8.7%, 8.5%, and 9.1%, respectively.*

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

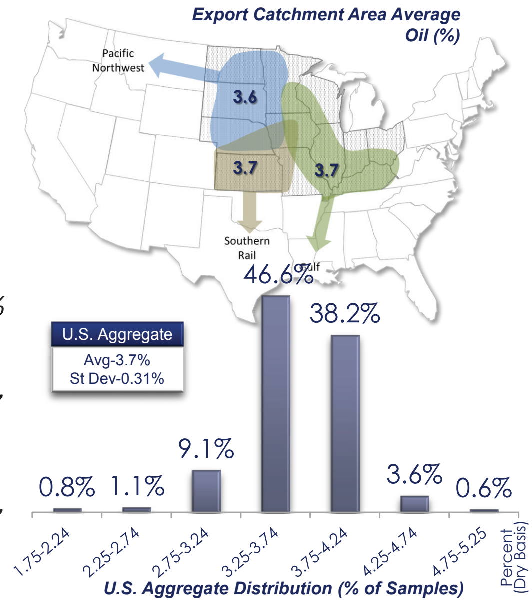
- *The U.S. Aggregate starch averaged 73.4%.*
- *Starch ranged from 71.5% to 75.4% with a standard deviation of 0.62% for the U.S. Aggregate.*
- *The majority of the samples had a starch concentration in the 73.0% to 73.99% range.*
- *Starch averages for corn expected to go to the Gulf, Pacific Northwest, and Southern Rail regions were 73.5%, 73.6% and 73.1%, respectively.*

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 byproduct of corn wet and dry milling. Results are reported on a dry basis.

HIGHLIGHTS

- *U.S. Aggregate oil averaged 3.7%.*
- *Oil ranged from 2.0% to 5.0% with a standard deviation of 0.31% for the U.S. Aggregate.*
- *Oil was distributed with 46.6% of the samples at 3.25% to 3.74%, and 38.2% of samples at 3.75% to 4.24%.*
- *Oil averages for corn expected to go to the Gulf, Pacific Northwest, and Southern Rail regions were 3.7%, 3.6% and 3.7%, respectively. Thus, there is likely no noteworthy differences in oil content of corn expected to go to any of these catchment areas.*



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Corn Quality Overview (2011 Harvest)

Chemical Composition Summary

Highlights

- *In addition to genetics, the average protein content (8.7%) is affected to some extent by crop yields (bushels per acre) and available nitrogen during the growing season.*
- *Starch content (73.4%) was relatively high which in combination with observed high test weights indicates good kernel filling that should be good for all processing uses and feeding.*
- *Oil content (3.7%) was relatively constant across all export catchment areas.*

Chemical Composition Summary

	No. of Samples	Average	Std. Dev.	Minimum	Maximum
U.S. Aggregate					
Protein (Dry Basis %)	474	8.7	0.60	6.7	12.5
Starch (Dry Basis %)	474	73.4	0.62	71.5	75.4
Oil (Dry Basis %)	474	3.7	0.31	2.0	5.0
Gulf					
Protein (Dry Basis %)	364	8.7	0.63	6.7	12.5
Starch (Dry Basis %)	364	73.5	0.64	71.5	75.4
Oil (Dry Basis %)	364	3.7	0.32	2.0	5.0
Pacific Northwest					
Protein (Dry Basis %)	182	8.5	0.52	6.7	11.0
Starch (Dry Basis %)	182	73.6	0.56	71.6	75.4
Oil (Dry Basis %)	182	3.6	0.26	2.8	4.7
Southern Rail					
Protein (Dry Basis %)	149	9.1	0.62	6.7	12.5
Starch (Dry Basis %)	149	73.1	0.65	71.5	74.6
Oil (Dry Basis %)	149	3.7	0.33	2.0	5.0

PHYSICAL FACTORS

There are tests for other physical factors that are quality attributes but not grading factors or chemical composition. These tests provide additional information about the processability of corn for various uses, as well as its storability and potential for breakage in handling. The processability, storability and ability to withstand handling 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, but 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, while the germ contains oil and some proteins, and the pericarp and tip cap are mostly fiber.

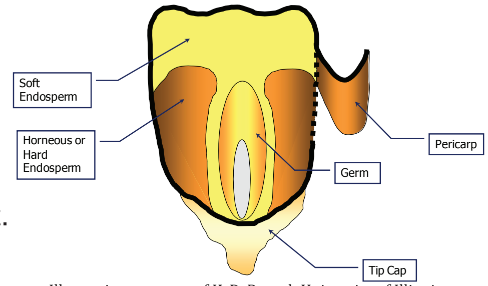


Illustration courtesy of K. D. Rausch University of Illinois

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

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.

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 hard 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 operatons).

Alkaline Cooking

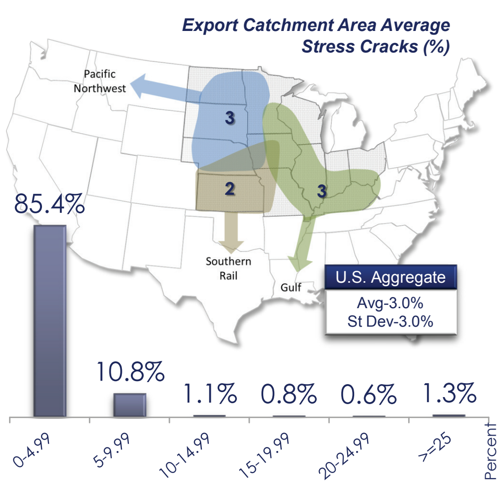
Non-uniform water absorption leading to overcooking or undercooking, which affects the process balance.

Growing conditions will greatly affect the need for artificial drying, thus influencing the degree of stress cracking found from region to region. For example, late maturity and late harvest due to factors such as rain-delayed planting or cool temperatures tend to increase the occurrence of stress cracks due to the need for artificial drying.

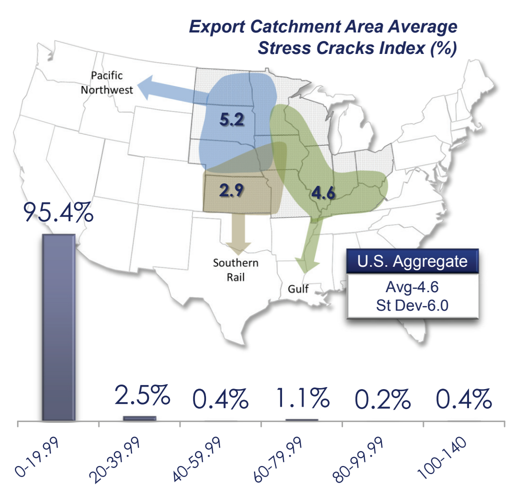
Measurements of stress cracks include Stress Crack Percent (the percentage of kernels with at least one crack) and Stress Crack Index (SCI) which is the weighted average of single, double and multiple stress cracks. The Stress Crack Percent reports only the number of kernels with stress cracks whereas SCI shows the severity of cracking. For example, if half the kernels have only single stress cracks, the SC% is 50 and the SCI is 50. However, if all the cracks are multiple stress cracks, indicating higher potential for handling issues, the SC% remains at 50 but the SCI becomes 250. Lower numbers for the percentages and index are always better. In years with very high stress crack percentages, the SCI is valuable because high SCI numbers (perhaps 300 to 500) indicate the sample had a very high percentage 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 3.0%.**
- **Stress cracks ranged from 0% to 40% with a standard deviation of 3.0%[2].**
- **Stress cracks distribution showed 96.2% of samples with less than 10% stress cracks.**
- **The percent of stress cracks for all regions including the Gulf, Pacific Northwest and Southern Rail areas was extremely low averaging only 2.0% to 3.0%.**
- **Stress crack index (SCI) had a very low Aggregate average of 4.6 from a range of 0 to 129, which indicates a very low amount of stress-cracked kernels had multiple stress cracks; samples with high SCI were few and far between.**
- **Over 97% 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 indicate reduced rates of breakage when corn is handled, impr**oved wet milling starch recovery, improved dry milling yields of flaking grits, and good alkaline *process ability.*



U.S. Aggregate Stress Cracks Distribution (% of Samples)



U.S. Aggregate Stress Cracks Index Distribution (% of Samples)

2 One sample contained a high level of stress cracks, resulting in 77% stress cracks and an SCI of 303. A high stress crack percentage and SCI are evidence of rapid drying of the grain, usually by means of high-temperature artificial drying. Based on other samples in the same Agricultural Statistical Districts (ASD), this sample appeared to be an outlier and was replaced with another sample from the same ASD.

Corn Quality Overview (2011 Harvest)

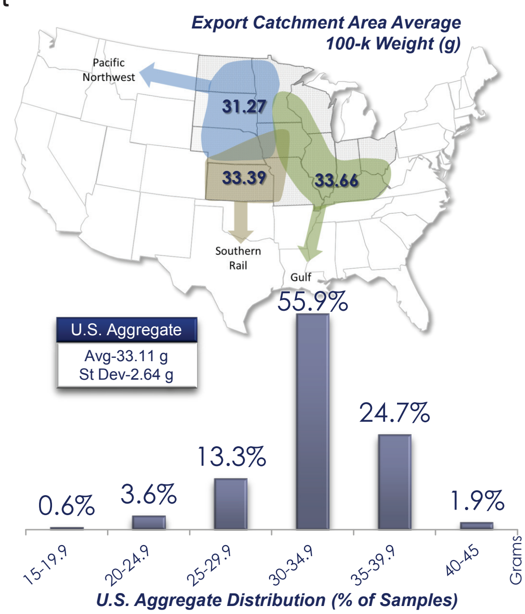
U.S. GRAINS COUNCIL

100-Kernel Weight, Kernel Volume and Kernel True Density

100-kernel weight (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 endosperm.

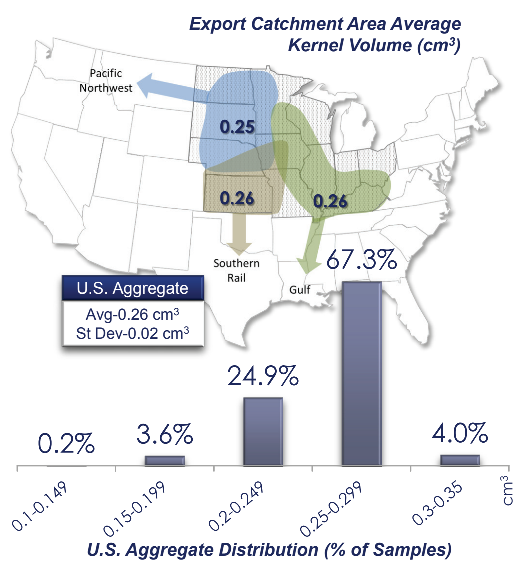
Kernel volume in cm³ is often indicative of growing conditions. If conditions are dry, kernels may be smaller than average. If drought hits later in the season, kernels may have lower fill. Small or round kernels are more difficult to degerm. Additionally, small kernels may lead to increased cleanout loss for processors and higher yields of fiber.

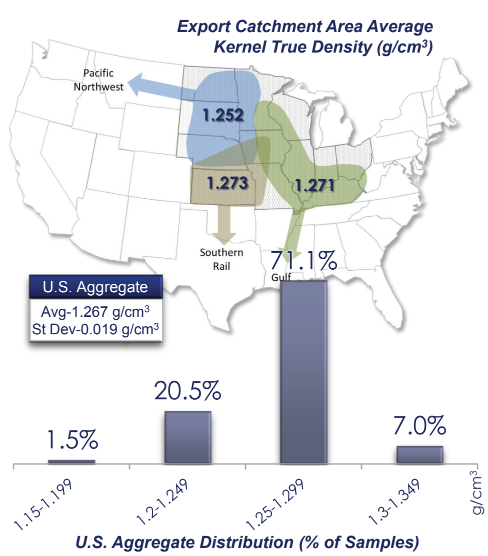
Kernel true density is calculated as the 100-kernel weight of a sample divided by the volume, or displacement, of those 100 kernels. True density is a relative indicator of kernel hardness, which is useful for alkaline processors and dry millers. True density, as a relative indicator of hardness, may 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/cm³ would indicate very hard corn desirable for dry milling and alkaline processing. True densities near the 1.275 g/cm³ level and below tend to be softer, but will process well for wet milling and feed use.



Highlights

- *100-k weight averaged 33.11 g for U.S. Aggregate corn with a range of 16.59 to 44.48 g/100 kernels. This shows a wide range of kernel sizes was found across all regions.*
- *The 100-k weights were distributed so that over 81% of the aggregate samples had 100-kernel weights of 30.0 g or greater.*
- *Kernel volume averaged 0.26 cm³ for U.S. Aggregate corn and ranged from 0.14 to 0.34 cm³.*
- *There was little difference in kernel volume among ECAs.*
- *Kernel true density averaged 1.267 g/cm³ for U.S. Aggregate corn. It ranged from 1.163 to 1.328 g/cm³.*
- *Between regions, Pacific Northwest had slightly lower average true density with 1.252 g/cm³ .*
- *The Southern Rail region had the highest true densities averaging 1.273 g/cm³.*





WHOLE KERNELS

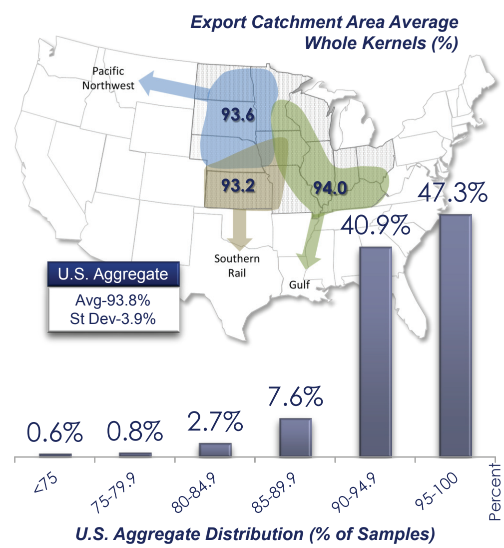
Though the name suggests some relationship between whole kernels and BCFM, the whole kernels test conveys different information than the broken corn portion of the BCFM test. Broken corn (BC) is defined solely by the size of the material. Whole kernels, as the name implies, is a measure of the quantity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

The exterior integrity of the corn kernel is very important for two key reasons. First, it 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 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

- *Whole kernel percentages averaged 93.8% for U.S. Aggregate corn with a range of 57.0% to 99.8%.*[3]
- *Whole kernel averages for Gulf, Pacific Northwest, and Southern Rail were 94.0%, 93.6%, and 93.2%, respectively.*
- *Over 88% of the U.S. Aggregate samples had whole kernels percentages of > 90%.*
- *Whole kernel percentages were relatively high and represent farm corn inbound to country elevators. The relatively high initial whole kernel percentages should reduce storage risk, and in combination with the low stress cracks enable reduced breakage in handling.*

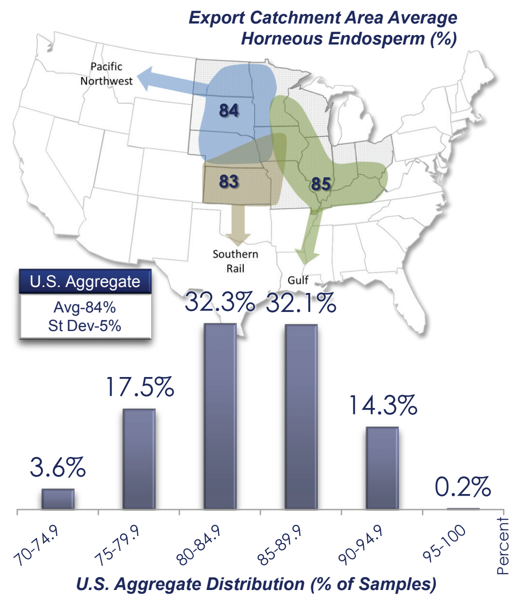


3 The sample with 57% whole kernels was the only sample with less than 70% whole kernels of the entire survey. The breakage was possibly due to poor combine settings and/or handling conditions.

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, moderate to soft hardness for wet milling and livestock feeding, and medium to medium-high hardness is desired for alkaline cooking.

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

- *Hard endosperm averaged 84% for U.S. Aggregate corn with a range of 71% to 95%.*
- *Hard endosperm percentages did not vary substantially across ECAs.*
- *U.S. Aggregate corn had 78.9% of the samples with greater than 80% hard endosperm.*

U.S. GRAINS COUNCIL

Corn Quality Overview (2011 Harvest)

Physical Factors Summary

Highlights

- *The low levels of stress cracks observed should indicate the potential for reduced rates of breakage when corn is handled, improved wet milling starch recovery, improved dry milling yields of flaking grits, and good alkaline process ability, but this potential may yet be affected by further drying and handling.*
- *Kernel true densities were in a medium range which should be good for wet milling and feeding, yet samples at the high levels (over 1.30 g/cm³) indicate availability of corn for dry milling and alkaline processing uses.*
- *The relatively high initial whole kernel percentages (93.8%) in combination with the low stress cracks percentage (3%) provides indication of good storable corn that should also have reduced breakage in handling.*

Physical Factors Summary

	No. of Samples	Average	Std. Dev.	Minimum	Maximum
U.S. Aggregate					
Stress Cracks (%)	474	3	3	0	40
Stress Crack Index	474	4.6	6.0	0	129
100-Kernel Weight (g)	474	33.11	2.64	16.59	44.48
Kernel Volume (cm³)	474	0.26	0.02	0.14	0.34
True Density (g/cm³)	474	1.267	0.019	1.163	1.328
Whole Kernels (%)	474	93.8	3.9	57.0	99.8
Horneous Endosperm (%)	474	84	5	71	95
Gulf					
Stress Cracks (%)	364	3	3	0	40
Stress Crack Index	364	4.6	6.3	0	129
100-Kernel Weight (g)	364	33.66	2.63	16.59	44.48
Kernel Volume (cm³)	364	0.26	0.02	0.14	0.34
True Density (g/cm³)	364	1.271	0.019	1.168	1.328
Whole Kernels (%)	364	94.0	3.9	57.0	99.8
Horneous Endosperm (%)	364	85	5	71	95
Pacific Northwest					
Stress Cracks (%)	182	3	3	0	35
Stress Crack Index	182	5.2	6.6	0	129
100-Kernel Weight (g)	182	31.27	2.59	21.82	44.48
Kernel Volume (cm³)	182	0.25	0.02	0.18	0.34
True Density (g/cm³)	182	1.252	0.021	1.163	1.314
Whole Kernels (%)	182	93.6	3.9	74.8	99.6
Horneous Endosperm (%)	182	84	4	71	95
Southern Rail					
Stress Cracks (%)	149	2	2	0	11
Stress Crack Index	149	2.9	3.0	0	21
100-Kernel Weight (g)	149	33.39	2.80	16.59	44.48
Kernel Volume (cm³)	149	0.26	0.02	0.14	0.34
True Density (g/cm³)	149	1.273	0.017	1.163	1.314
Whole Kernels (%)	149	93.2	3.8	71.0	99.2
Horneous Endosperm (%)	149	83	4	71	95

Mycotoxins

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

The 2011 Harvest Report assesses the presence of measurable levels of these two mycotoxins in corn at harvest. 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 at harvest are not the same as what might appear in export cargoes. Therefore, the objective of the 2011 Harvest Report is strictly to report on instances when aflatoxins or DON were detected in some of the samples. No specific levels of the mycotoxins are reported.

The Harvest Report review of mycotoxins is NOT intended to predict the presence or level at which mycotoxins might appear in U.S. corn exports. In addition, this report is not meant to imply that this assessment will capture all the instances of mycotoxins across the twelve states surveyed. The Harvest Report results should be used only as one indicator of the potential for mycotoxin infection. Over several years, the Harvest Reports will reflect the year-to-year pattern of mycotoxin presence in corn as the crop comes out of the field. The Export Cargo Report, which reports corn at export points, will be a more accurate indication of mycotoxin presence in U.S. corn export shipments.

Assessing The Presence of Aflatoxins and DON

While the U.S. grain merchandising industry implements strict safeguards for handling and marketing any elevated levels of mycotoxins, interest has been expressed for early detection of mycotoxins resulting from the growing conditions during the current crop year. To assess the impact of the 2011 growing conditions on total aflatoxins and DON development, random testing of samples across the entire sampled area was conducted. One to four samples from each ASD were tested for the mycotoxins, depending on the total number of samples collected from each ASD (See the "Survey and Statistical Analysis Methods" section for explanation of ASDs.). If multiple samples were tested within an ASD, the samples came from different elevators.

A threshold referred to as the Limit of Detection (LOD) was used to determine whether or not an instance of the mycotoxin appeared in the sample. The LOD used for this report was 2.5 parts per billion (ppb) for aflatoxins and 0.5 parts per million (ppm) for DON. If any sample for either mycotoxin exceeded the respective LOD, a different sample in the same ASD was tested for the same mycotoxin. This was done for additional verification of the presence of the mycotoxin at an elevated level. Details on the testing methodology employed in this study for the mycotoxins are in the "Testing Analysis Methods" section.

Testing results

A total of 95 samples were analyzed for aflatoxins. All but two samples were below the LOD of 2.5 ppb. The remaining two sample test results were also above the FDA action limit of 20 ppb. The two samples with results above the LOD came from an area that had very hot and dry environmental conditions that would have favored the production of aflatoxins.

A total of 94 samples were tested for DON, and seventy-four of the samples were below the LOD of 0.5 ppm. However, all the samples contained DON levels below the FDA advisory level of 5.0 ppm. Most of the samples that were above the LOD of 0.5 ppm for DON were from corn growing areas where the weather was cool and wet during silking.

Mycotoxin Background: General

The levels at which the fungi produce the mycotoxins are impacted by the fungus type, and the 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 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, and 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.

Mycotoxin Background: Aflatoxins

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 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 system may be suppressed as a result

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 of ingesting aflatoxins.

The FDA has established action levels for aflatoxins in human food, grain and livestock feed products and aflatoxin M1 in milk intended for human consumption if the levels exceed:

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. Unless the contract allows for independent laboratory testing, the testing must be conducted by the USDA/GIPSA's Federal Grain Inspection Service (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.

Mycotoxin Background:
DON (Deoxynivalenol) or Vomitoxin

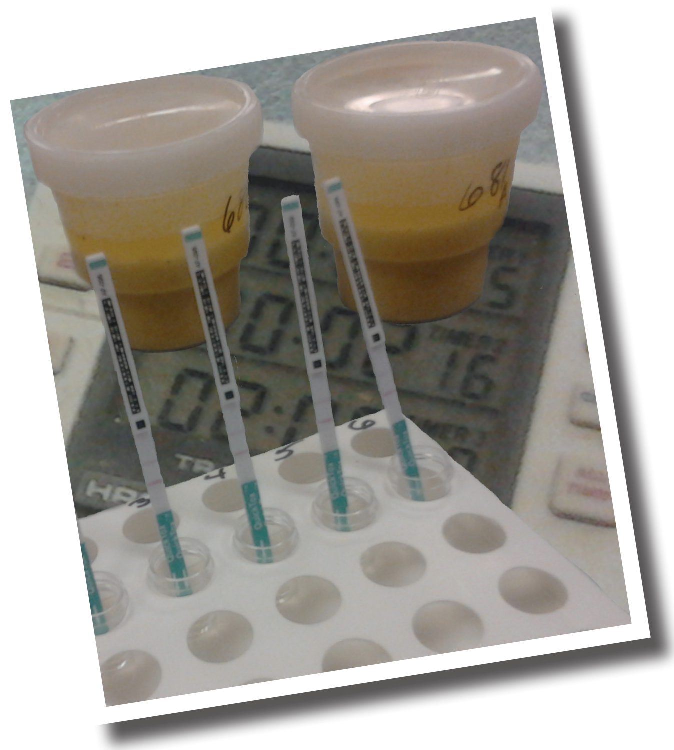
DON is another mycotoxin of concern to some importers of corn grain. It is produced by certain species of Fusarium, the most important of which is *Fusarium graminearum* (*Gibberella zeae*) which also causes Gibberella ear rot (or red ear rot). The fungus can be spotted easily in corn because of the 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 are evident during the grain inspection process. DON and Gibberella ear rot is most common in the northern Corn Belt states. This may be due to the susceptibility of very early maturing corn hybrids commonly grown in these areas to the fungus.

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



U.S. GRAINS COUNCIL

Crop and Weather Conditions

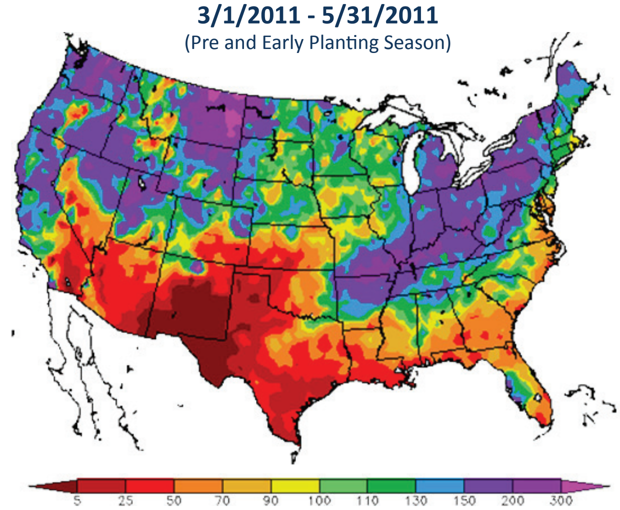
Weather plays a large role in planting and grain development, which, in turn, impacts final grain yield and quality. The principal weather factors include the amount of precipitation and the temperature just prior to and during the corn growing season. These weather factors interact with the corn variety and the soil fertility to power 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 number, or hinder the plant growth, which may result in lower yields. At pollination time, higher than average temperatures or lack of rain typically reduces the number of kernels. Critical to the final grain quality is the weather conditions during the grain filling period in July and August. During this time, moderate rainfall and lower than average temperature, especially overnight temperature, promotes starch accumulation and increased yields. At the end of the growing season, drydown of the grain is dependent upon sunny, warm, days with low humidity. Conversely, early freezing before the grain has sufficiently dried leads to cracked, low quality grain.

During the 2011 corn growing season, planting and pollination were challenged by adverse weather conditions, which, in turn, impacted final grain yield and quality. Overall, the weather in 2011 involved poor conditions for pollination, which led to decreased kernel numbers per plant and lowered yields in all ECAs (See the "U.S. Corn Production, Usage and Outlook" section for information on yields.). However, the reduced amount of kernels available to be filled moderated the effects of the heat wave and drought in the Gulf and Pacific Northwest ECAs and led to grain with relatively high average test weights. The Gulf region produced the greatest yield, with some of the drought and heat tempered by the earlier rains. The Southern Rail region encountered weather conditions that resulted in the lowest yields, but the greatest protein concentrations and highest test weights. Conditions for field drying prior to harvest were generally favorable in all ECAs, as indicated by low average grain moisture contents.

The following discussion describes in more detail how precipitation and temperature impacted the 2011 corn planting season, and how the weather events affected pollination and the remainder of the growing season.

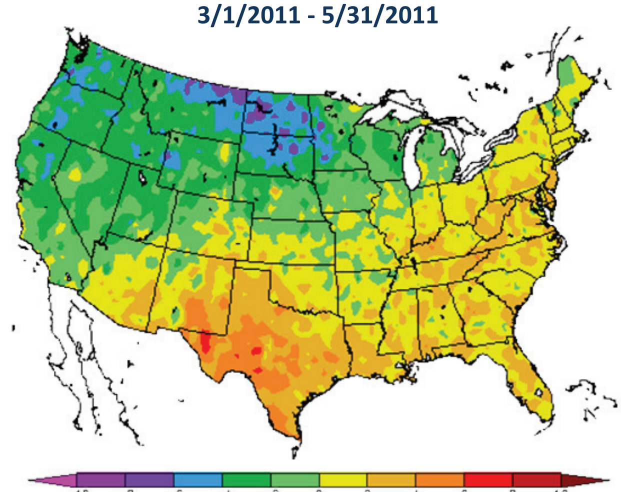
Just prior to, and during planting, the Ohio Valley and the Midwest (the Gulf and Pacific Northwest ECAs) experienced greater than average precipitation, with major flooding along the Ohio and Mississippi Rivers. In contrast, the Southern Rail ECA received below normal precipitation.

Percent of Normal Precipitation (%)
3/1/2011 - 5/31/2011
(Pre and Early Planting Season)



Generated 6/1/2011 at HPRCC using provisional data. Source: Regional Climate Centers

Departure from Normal Temperature (°F)
3/1/2011 - 5/31/2011



Generated 6/1/2011 at HPRCC using provisional data. Source: Regional Climate Centers

Crop and Weather Conditions

U.S. GRAINS COUNCIL

Also during this time, the upper Midwest experienced much cooler than normal temperatures. The combination of cool and wet weather delayed planting by an average of one week throughout the U.S. Typically, only 25% of the corn crop is planted after May 15, based on the 2006-2010 average as shown in the table below. However, in 2011, 37% of the corn remained to be planted. As a result, a higher proportion of the corn crop was planted later than what is considered optimum for yield. Delayed planting is generally associated with lower yields and often with poorer grain quality.

Comparison of Expected Corn Yields by Planting Date, 2011 U.S. Planting Progress, and the 2006-2010 Average U.S. Planting Progress

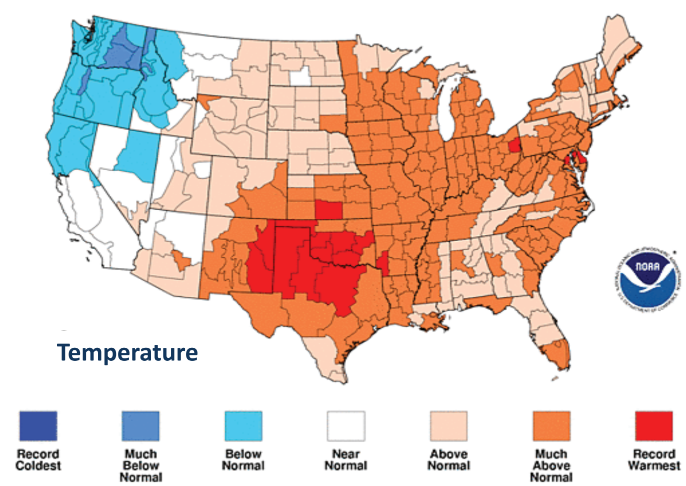
		2011		2006-2010 Average	
Planting Date	Proportion of Optimum Yields (%)	Cumulative Progress (%)	Weekly Progress (%)	Cumulative Progress (%)	Weekly Progress (%)
April 10	99	3	3	3	3
April 17	100	7	4	8	5
April 24	99	9	2	23	15
May 1	96	13	4	40	17
May 8	96	40	27	59	16
May 15	91	63	23	75	12
May 22	84	79	16	87	8
May 29	84	86	7	95	8
June 5	74	94	8	98	3

Source: http://www.farmdocdaily.illinois.edu/2011/06/interpreting_recent_data_on_co.html

Just before pollination time, on July 11, 2011, there was a large windstorm which is estimated to have had straight line winds of up to 105 mph in a swath approximately 20 miles wide. This storm, called a derecho, affected six states, and travelled between central Iowa to Detroit, Michigan, a distance of 550 miles in the Gulf ECA. Afterwards, there was an unusual occurrence of the majority of these flattened plants lifting back up on their own after a few days. Areas impacted by these severe winds would potentially have lower yield and quality.

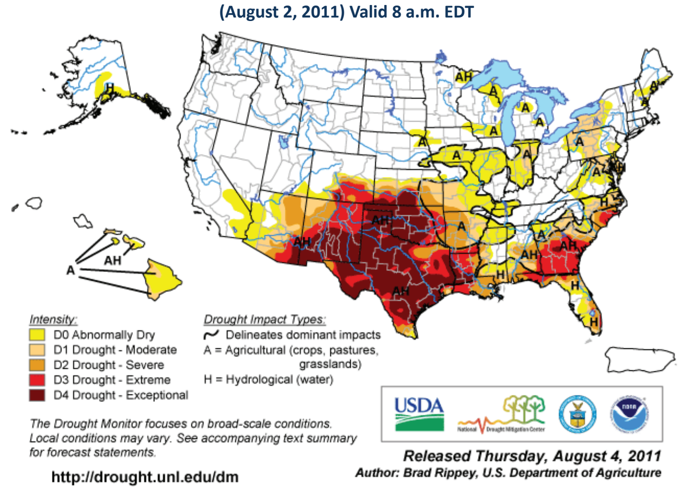
The major weather factor observed during the growing season was persistent, scorching heat in the central and eastern regions of the U.S. in July, primarily the Gulf and Southern Rail ECAs as shown in the map of July 2011 Divisional Ranks. The heat wave shattered long-standing daily and monthly temperature records, making it the fourth warmest July on recor nationally, according to scientists at NOAA's National Climatic Data Center. The heat exacerbated drought conditions, resulting in the largest "exceptional" drought footprint in the 12-year history of the U.S. Drought Monitor. The heat wave came at the prime pollination time and impeded pollination and seed set.

July 2011 Divisional Ranks



U.S. Drought Monitor

(August 2, 2011) Valid 8 a.m. EDT

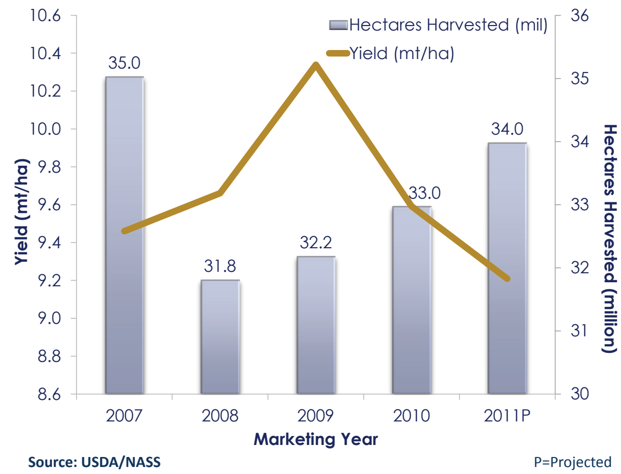


U.S. Corn Production, Usage and Outlook

U.S. Corn Production

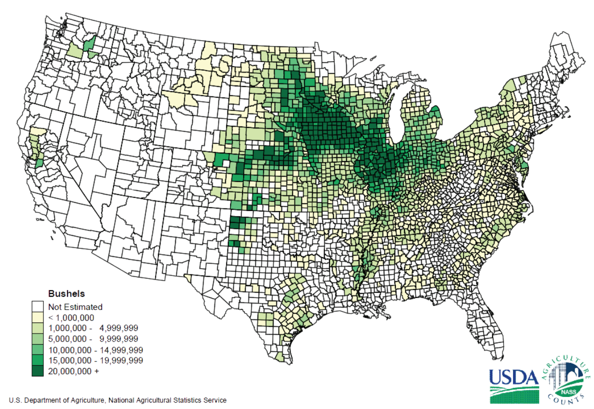
U.S. Average Production and Yields

- *Average U.S. yield for the 2011 crop is projected to be 9.2 mt/ha (146.7 bu/acre), 0.4 mt/ha (6.1 bu/acre) lower than the 2010 corn crop and the lowest average yield in the past five years.*
- *The number of hectares harvested in 2011 is projected to be 34.0 million (83.9 million acres), 1 million hectares (2.5 million acres) more than in 2010, and the greatest since 2007.*
- *Total U.S. corn production for 2011 is projected to be 312.7 mmt (12,310 million bushels), about 3.5 mmt (137 million bushels) lower than 2010, yet the fourth largest crop on record.*
- *The large U.S. corn production experienced in 2009 was due to a high average yield, while the lower total production in 2011 is primarily due to the lower average yield.*



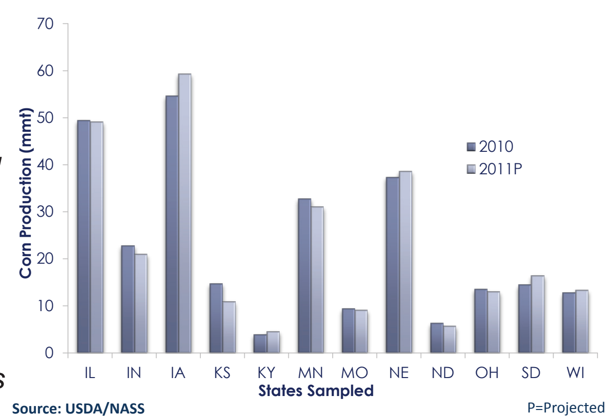
County and State Level Production

The geographic areas included in the Harvest Report corn quality survey include the highest producing counties in the U.S. This can be seen on the U.S. map showing 2010 corn production by county.



Projected state-level production in 2011 differed from 2010 production for several of the twelve states included in the Harvest Report corn quality survey:

- *Iowa produced 4.6 mmt (181mil bu) more corn in 2011 than 2010, because of both increased acreage and higher yields.*
- *Illinois production for both 2010 and 2011 is around 49.3 mmt (around 1,941 mil bu); the fairly flat production level is due to no significant change in acreage or average yields.*
- *Increased acres are responsible for Nebraska's increased 2011 production, 1.3 mmt (51 mil bu) more than in 2010.*
- *Minnesota's lower 2011 average yields overshadowed its increased acreage, resulting in a net decrease of 1.7 mmt (68 mil bu) production from 2010.*
- *Other notable 2011 production differences from 2010 include severe drought in Kansas impacting yields (a 20% decline from 2010 yields) and adverse weather conditions in Ohio and Indiana resulting in lower yields accompanied by fewer acres.*

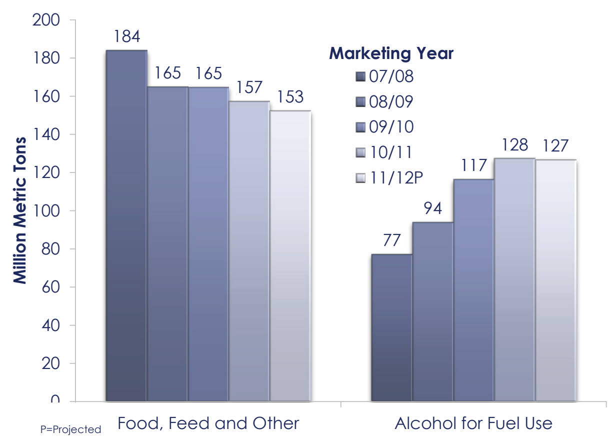


U.S. Corn Production, Usage and Outlook

U.S. GRAINS COUNCIL

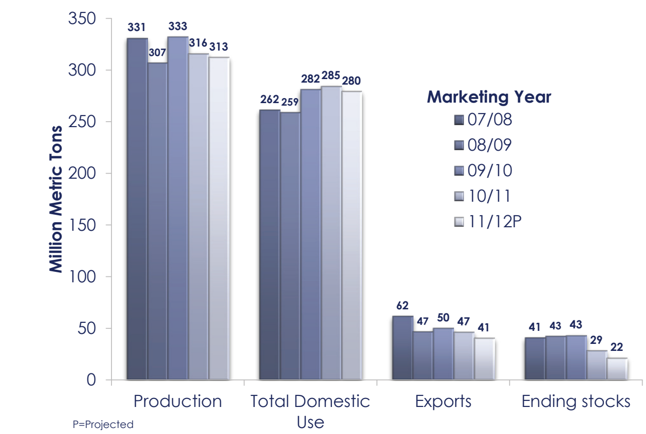
U.S. Corn Use and Ending Stocks

- *Domestic livestock feed use has shown a decline since MY07/08, driven in part by tight corn supplies and record corn prices, accompanied by declining meat demand in the U.S.*
- *U. S. corn use for food, seed and other non-alcohol industrial use has remained fairly constant since MY07/08.*
- *The growth in use for ethanol production, driven by the Renewable Fuels Standard, has supported overall domestic use of corn.*
- *Exports declined substantially after MY07/08. U.S. exports have been hampered by high corn prices due to strong domestic demand and increased global competition.*
- *Ending stocks fell substantially in MY10/11 due to demand continuing to exceed supply.*



Source: USDA/NASS

P=Projected



Source: USDA/NASS

P=Projected

Outlook

U.S. Outlook

Usage

The total U.S. corn domestic use for MY11/12P, while about 7% greater than in MY07/08, is expected to be 1.8% lower than in MY10/11, primarily because of lower expected overall feed grain use.

Projected feed use reflects:

- *Record hog and cattle prices accompanied by large initial feedlot inventories supporting feed demand.*
- *However, reduced broiler production and prospects for fewer cattle going on feed in 2012 indicating weaker feed demand.*

USDA is expecting high fructose corn syrup (HFCS) demand for MY11/12 to remain about the same as MY10/11. This demand outlook is accompanied by higher HFCS prices due to higher input costs.

While U.S. ethanol production has experienced growth over the past few years, corn use for ethanol production in MY11/12 is expected to remain flat. This is in part due to the blender tax credit expiring December 31, 2011, and the expectation that it will not be renewed. The 15% ethanol blend that will become broadly

U.S. Corn Production, Usage and Outlook

available in 2013 could boost corn alcohol use for biofuel production in the future.

U.S. exports for MY11/12 are projected to be weaker than in MY10/11. This is partially because of increased competition from Argentina and Ukraine for corn and from feed quality wheat. In addition, concerns about world economic and financial conditions and strong U.S. corn prices are dampening export demand for U.S. corn.

MY11/12 is projected to close with historically tight U.S. ending stocks of around 21.5 mmt as reductions in supply exceed reductions in use.

International Outlook

Global Production

- *Corn production outside the U.S. during MY11/12 is expected to be larger than the previous marketing year.*
- *Sources of higher global production include more corn acres in Argentina, higher production in China stemming from both increased area and yields, and increased production in the Black Sea area of the EU-27.*
- *Mexico is expected to have a smaller corn supply due to adverse planting and growing season weather conditions.*
- *Exports from Argentina and the EU-27 are expected to be higher in MY11/12.*

U.S. Corn Supply and Usage Summary

Metric Units	07/08	08/09	09/10	10/11	11/12P
Acreage (million hectares)					
Planted	37.9	34.8	35.0	35.7	37.2
Harvested	35.0	31.8	32.2	33.0	34.0
Yield (metric ton/hectare)	9.5	9.7	10.3	9.6	9.2
Supply			*(millions of metric tons)*		
Beginning stocks	33.1	41.3	42.5	43.4	28.7
Production	331.2	307.1	332.6	316.2	312.7
Imports	0.5	0.3	0.2	0.7	0.4
Total Supply	364.8	348.7	375.3	360.2	341.7
Usage					
Food, seed, other non-alcohol ind. use	35.4	33.4	34.8	35.7	35.8
Alcohol for fuel use	77.5	94.2	116.6	127.5	127.0
Feed and residual	148.8	131.6	130.2	121.7	116.8
Exports	61.9	47.0	50.3	46.6	40.6
Total Use	323.5	306.2	331.9	331.6	320.2
Ending Stock	41.3	42.5	43.4	28.7	21.5
Avg. Farm Price ($/mt*)	165.35	159.83	139.76	203.93	232.27 - 271.64

English Units	07/08	08/09	09/10	10/11	11/12P
Acreage (million acres)					
Planted	93.5	86.0	86.4	88.2	91.9
Harvested	86.5	78.6	79.5	81.4	83.9
Yield (bushels/acre)	150.7	153.9	164.7	152.8	146.7
Supply			*(millions of bushels)*		
Beginning stocks	1,304	1,624	1,673	1,708	1,128
Production	13,038	12,092	13,092	12,447	12,310
Imports	20	14	8	28	15
Total Supply	14,362	13,729	14,774	14,182	13,453
Usage					
Food, seed, other non-alcohol ind. use	1,393	1,316	1,370	1,407	1,405
Alcohol for fuel use	3,049	3,709	4,591	5,021	5,000
Feed and residual	5,858	5,182	5,125	4,792	4,600
Exports	2,437	1,849	1,980	1,835	1,600
Total Use	12,737	12,056	13,066	13,055	12,605
Ending Stock	1,624	1,673	1,708	1,128	843
Avg. Farm Price ($/bushel*)	4.20	4.06	3.55	5.18	5.90 - 6.90

*Farm prices are weighted averages based on volume of farm shipment.
Avg. farm price for 11/12F based on WASDE December projected price.
P=Projected

Source: USDA/ERS

Global Demand

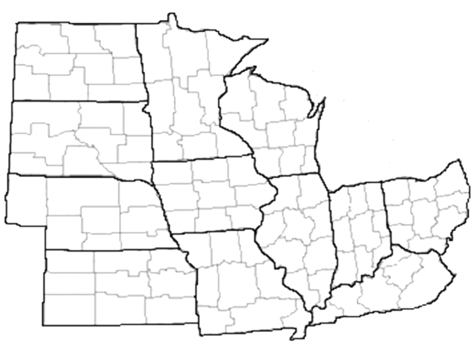
- *Global demand is expected to remain strong due to expanding meat production in many countries.*
- *China continues to import corn due to strong demand for industrial and feeding use and to maintain stocks.*

Survey and Statistical Analysis Methods

U.S. GRAINS COUNCIL

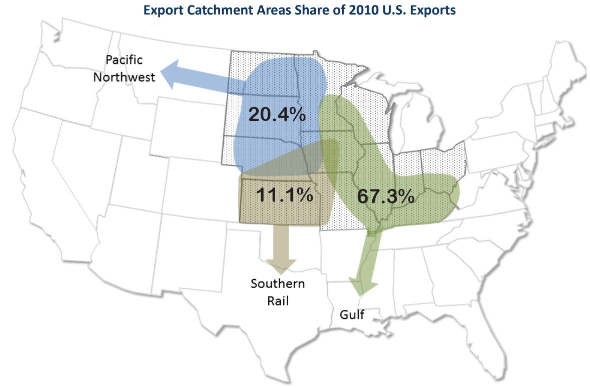
Sample Design and Sampling

We 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.



Stratified sampling 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 twelve key corn producing states representing 98% of the 2010 U.S. corn exports (USDA). From those data, we calculated each ASD's proportion of the total production and foreign exports to determine the ***sampling proportion*** and ultimately, the number of corn samples to be collected from each ASD. The number of samples collected for the Harvest Report differed from ASD to ASD because of their different shares of estimated production and foreign export levels.

The ***random selection*** process was implemented by soliciting country grain elevators in the twelve states by mail, fax, e-mail and phone. Postage-paid sample kits were mailed to elevators agreeing to provide the 2,050 to 2,250 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. In addition, elevators were requested to submit only samples of corn with up to 22% moisture. This criterion was used to prevent sample deterioration during shipping. 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.



U.S. GRAINS COUNCIL

Survey and Statistical Analysis Methods

Statistical Analysis

The sample test results for the grade factors, 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. We labeled these "Export Catchment Areas" (ECAs) as follows: the Gulf ECA consisting of areas that typically export corn through the U.S. Gulf ports, the Pacific Northwest (PNW) ECA comprising of areas that export corn through Pacific Northwest and California ports, and the Southern Rail ECA that includes areas generally exporting corn by rail to Mexico.

In analyzing the sample test results, we followed the standard statistical techniques employed for proportionate stratified sampling including weighted averages and standard deviations. (In some instances, the ASDs were over-sampled, and in those cases, the statistics were adjusted to account for the over-sampling.) 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. These estimations were based on industry input and evaluation of studies of grain flow in the U.S.

Testing Analysis Methods

The corn samples were sent directly from the country grain elevators to the Illinois Crop Improvement Association Identity Preserved Grain laboratory (IPGL) in Champaign, Illinois. Upon arrival at IPGL, the samples were split into two subsamples using a Boerner divider. 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 the Grain Inspection, Packers and Stockyards Administration (GIPSA). The grade testing procedures were in accordance with GIPSA's Federal Grain Inspection Service (FGIS) Grain Inspection Handbook, and are described in the following section. The other subsample was dried to approximately 15% moisture and analyzed at IPGL for the chemical composition and other physical factors following either industry norms or well-established procedures in practice for many years. IPGL has received accreditation under the ISO/IEC 17025:2005 International Standard.

Corn Grading Factors

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 GIPSA Official United States Standards for Grain 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).

Broken Corn & Foreign Material (BCFM)

Broken Corn & Foreign Material is part of the GIPSA Official United States Standards for Grain grading criteria.

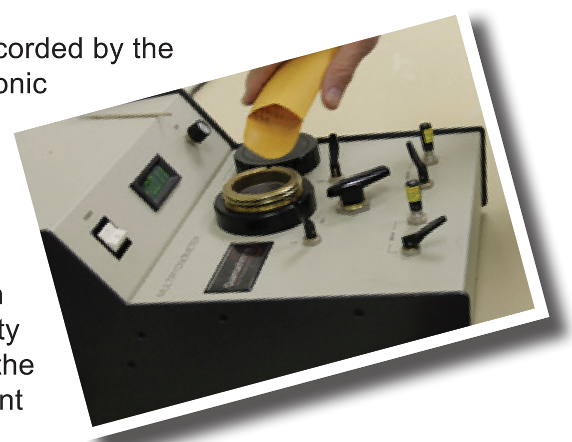
This test determines the amount of all matter that passes through a 12/64th inch round-hole sieve and all matter other than corn that remains on the top of the sieve. Broken corn is defined as all material passing through a 12/64th inch round-hole sieve and retained on a 6/64th sieve. Foreign material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

Total Damage/Heat Damage

Total Damage is part of the GIPSA Official United States Standards for Grain 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, drier-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 is 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.

Moisture



The moisture recorded by the elevators' electronic moisture meter 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. Moisture is reported as a percent of total wet weight.

Testing Analysis Methods

Chemical Composition

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 400–450 g 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 basis percentage (percent of non-water material).

Physical Factors

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 with a minimum of four decimal places. The averaged 100-kernel weight is reported in grams.

The kernel volume is determined using a helium pycnometer to determine the volume (displacement) of the two replicates, and is expressed in cm^3/100. Kernel volumes usually range from 0.18-0.30 cm^3 per kernel for small and large kernels, respectively.

True Density is calculated as the mass (or weight) of the two replicates of 100 externally sound kernels by the volume (displacement) of the same 100-kernels. The replicate results are averaged. True Density is reported in grams per cubic centimeter (g/cm^3). True densities typically range from 1.20 to 1.35 g/cm^3 at "as is" moistures of about 12 to 15%.

Stress Crack Analysis

Stress Crack Percent is 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 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 Crack Percent is expressed as all kernels containing one, two or more than two cracks divided by 100 kernels. Lower Stress Crack Percent is always better since high stress crack percentages 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.

Whole Kernels/Cracked & Broken

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%.

% 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.

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.

GIPSA’s protocol requires a minimum of a 4,540 gram (10 pound) sample from large lots such as barges/sublots to grind for aflatoxin testing. The large sample size 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 GIPSA sampling process is to minimize under-estimating or over-estimating the true mycotoxin concentration since accurate results are imperative for corn exports. However, the objective of the Harvest Report assessment of aflatoxins was 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 4,540 grams per sample for the Harvest Report aflatoxins testing, so a smaller sample size was used. Using a smaller sample size for testing for aflatoxins increases the potential for over- or under-estimating the specific level of aflatoxins in the sample if the aflatoxins levels are reported. However, only the number of instances above the specified threshold is being reported.

For this study, a 200 gram laboratory sample was subdivided from the 2 kg survey sample of shelled kernels for the aflatoxin analysis. The sample was ground in a mill to pass a 20 mesh screen. From this well-mixed comminuted material, a 40-gram test portion was removed for the testing. EnviroLogix AQ 109 BG test kits were used for the analysis, and the manufacturer – Envirologix – specifies extracting aflatoxins from 20 to 50 gram test portions. The aflatoxins were extracted with 50% ethanol (2:1). The extracts were tested using the Envirologix QuickTox™ lateral flow strips, and the aflatoxins were quantified by the QuickScan™ system. GIPSA has issued a Certificate of Conformance for the EnviroLogix QuickTox™ kit for QuickScan™ for quantitative aflatoxin determination in corn.

For the DON testing, the Romer AgraQuant test method, as approved by the USDA/GIPSA, was used. An approximately 1350-gram portion was ground by a Romer Mill to a particle size which would pass through a number 20 wire mesh sieve and divided down to a 50-gram sample using a riffle divider. The sample was then processed as the USDA/GIPSA DON (Vomitoxin) Handbook requires. The DON was extracted with 250 ml of distilled water, and the extracts were tested using the Romer AgraQuant micro well test kits. The DON results were read using the StatFax Reader.

Grade Requirements and Conversions

U.S. GRAINS COUNCIL

Corn Grades and Grade Requirements

Grade	Minimum Test Weight per Bushel (Pounds)	Maximum Limits of Damaged Kernels: Heat Damaged (Percent)	Maximum Limits of Damaged Kernels: 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 cocklebурs (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 (MT/ha)	1 metric ton (MT) =	2204.6 lbs
1 bushel/acre =	62.77 kilograms/hectare	1 metric ton (MT) =	1000 kg
1 bushel/acre =	0.6277 quintals/hectare	1 metric ton =	10 quintals
56 lbs/bushel =	72.08 kg/hecto liter	1 quintal =	100 kg
		1 hectare =	2.47 acres

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