Agronomy Guide

Purdue University Cooperative Extension Service

CROPS (CORN) AY-225

USDA Grading Standards and Moisture Conversion Table for Corn

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Corn is defined as any grain consisting of 50 percent or more whole kernels of shelled dent corn and/or flint corn. It may not contain more than 10 percent of other grains for which grading standards have been established. Lots of grain not meeting these standards are considered mixed grain. The USDA agency entitled "Grain Inspection, Packers, and Stockyard Administration (GIPSA)" develops and maintains the rules of the grain grading industry.

Most importantly, one must obtain a representative sample of the grain lot for information obtained from grading procedures to be meaningful. There are several devices used for obtaining a grain sample. Some type of probe is typically used for grain which is contained in a barge, truck, railroad car, etc. Samples from flowing grain are often taken using an Ellis Cup or a Pelican sampling device. Grain samples should never be obtained by skimming or dipping from any contained grain. For more information about sampling refer to the USDA Federal Grain Inspection Handbook-Book I. Requests for this can be made by calling GIPSA at 301-734-5524 or faxing to the attention of Ed Lawson at 301-734-8455. Book II goes into detail for each grain for which standards have been established. This agronomy (AY Publication) is only to be used to provide an overview for understanding a grain grading certificate and grading process and is not meant to replace any part of the Federal Grain Inspection Handbook.

Class- After the removal of broken corn & foreign material, the next step is to determine the correct class. The following describes the three classes of corn:

Yellow Corn - Yellow-kerneled corn cannot contain more than 5 percent corn of other colors. Yellow kernels with a slight tinge of red are considered yellow corn.

White Corn - White-kerneled corn that does not contain more than 2 percent corn of other colors. White corn with a slight tinge of pink is white corn.

Mixed Corn - Corn that does not meet the color requirements of white or yellow corn. When completing the grain inspection certificate, record the percent of each corn (class) from greatest to least in percentage to nearest tenth within the "Remarks" section. The following are examples of class determination:

Example	Correct class
1. 95% yellow corn = 5% white corn	Yellow Corn
2. 98% white corn = 2% yellow corn	White Corn
3. 96% yellow corn = 4% white corn	Yellow Corn
4. 89% yellow corn = 11% white corn	Mixed Corn

Moisture - Moisture is not a grading factor in commercial grain. However, a loss of quality in stored corn hinges largely on the amount of moisture present in the grain. Moisture is an important factor in most discount schedules. Moisture is recorded on the grain certificate to the nearest tenth of a percent. (e.g. 16.27% recorded as 16.3%).

Grading Factors in Corn

Broken Corn and Foreign Material (BCFM) - This factor is determined using a sieve. Broken corn and all matter other than corn that pass through a sieve having round openings 12/64th of an inch in diameter, and all matter other than corn that remain on the sieve after screening are included in this factor. Sweet corn and pop corn are forms of BCFM in corn grading. Soybeans not passing through the sieve would be an example of BCFM. Also included

would be wheat or oats that would drop through the screen. Rodent excreta and stones are also part of BCFM. Record BCFM to the nearest tenth of a percent.

Test Weight - The amount of weight the grain must have to make up a bushel. Good quality corn of low moisture content can be expected to have a good test weight. Record test weight in whole and half pounds disregarding fractions of a half pound. Example 52.34 lbs/bu is recorded as 52.0 lbs/bu.

Heat-damaged Kernels - Heat damaged corn is severely discolored (brown to black) either from external heating, such as improper drying, or from heating and spoiling as a result of excessive moisture in storage. This differs from damaged by heat (slightly discolored kernel) in that heat damage severely discolors the entire kernel. Slightly damaged corn shows some discoloration (light to dark tan) and therefore is not as severely damaged. The two are not added together to determine heat damaged kernels. Heat-damaged kernels are included as part of Damaged Kernels (Total). Use the reference "Corn Kernel Damage" to help you understand this determination which is recorded to the nearest tenth of a percent.

Damaged Kernels (Total) - This factor includes all types of damage found in corn and is often abbreviated or referred to as *DKT*. Darkening of the germ is one of the first indicators that corn is declining in quality or that the amount of damage is increasing. DKT includes: mold damage, heat damage, sprout damage, frost damage, badly ground-damaged, badly weather-damaged, some forms of insect damage, and kernels that have become slightly discolored from heat. Note that the percent of heat damage is added to other types of damage to obtain the percent of DKT. Use the reference publication "Corn Kernel Damage" to help you make these determinations whose sum is rounded to the nearest tenth of a percent.

Stones - If eight or more stones are present in a sample of 1-1/4 quarts (1,000 gm.) and the total weight of the stones exceeds 0.2 percent of the sample weight, the sample must be graded "U.S. Sample Grade". Cinders are considered Stones. When applicable, "stones" is recorded in the "Remarks" section of the certificate.

Musty, Sour or Heating - A sample in any of these conditions is "U.S. Sample Grade". These conditions include mold smell, fermentation, pig pen smell, etc. The applicable words are recorded in the "Remarks" section of the grading certificate.

Commercially Objectionable Foreign Odor - If the corn carries an odor which does not normally occur in grain and which, for this reason, would render the corn unfit for its normal commercial use, then it is graded "U.S. Sample Grade". This includes odor from animal hides, decaying animal or vegetable parts, fertilizer, skunk, smoke, strong weed, oil, etc. The words "Commercially Objectionable Foreign Odor are recorded in the "Remarks" section of the certificate when this occurs.

Distinctly Low Quality - The Grain Inspection, Packers, and Stockyard Administration (GIPSA) reserves the use of this term to describe corn that is obviously of inferior quality and the existing grading factors or guidelines do not accurately reflect the inferior condition. Grain Inspectors are advised to use all available information to determine whether corn is of Distinctly Low Quality. When a sampler is collecting corn from a rail car, he/she can notice whether the grain also includes two or more large stones, pieces of glass, pieces of concrete, sticks of lumber, or scrap metal or debris which are visible to the sampler but are too large to enter the sampling device, such as a grain probe. To illustrate, corn is described as containing "plywood scraps". From information above, the corn would be designated: Distinctly Low Quality (Plywood scraps). This grading factor should not be confused with the other conditions which can also cause corn to be "Sample Grade", such as animal filth, cockleburs, crotalaria seed, etc. The words "Distinctly Low Quality" and the reason(s) are recorded in the "Remarks" section of the certificate when these factors occur.

Special factors, special grade requirements, and special grade designations are as follows:

Flint - Corn of any class which consists of 95 percent or more of flint corn; flint corn is graded and designated according to the grade requirements of the standards applicable to such corn if it were not flint, and the word "Flint" is added to and made a part of the grade designation, immediately following the class name.

Flint and Dent - Corn of any class which consists of a mixture of flint and dent corn containing more than 5 percent but less than 95 percent of flint corn. Flint and dent corn are graded and designated according to the grade requirements of the standards applicable to such corn if it were not flint and dent. On occurrence the words "Flint and Dent" and the approximate percentage of flint corn are added to and made a part of the grade designation immediately following the special grade. Example: U.S. No. 3 Yellow Corn, Flint and Dent, Flint Corn 27%.

Infested - Any corn sample of 1-1/4 quarts or 1000grams that contains two or more live weevils,

one live weevil and 5 or more other live insects injurious to stored grain, or 10 or more other live insects injurious to stored grain is considered infested. Infested corn is graded and designated according to the grade requirements of the standards applicable to such corn if it was not infested. The word “Infested” is added to and made a part of the grade designation.

Waxy Corn - Corn that consists of 95% or more waxy corn. When applicable, this special grade will be last within the grade designation.

Special grades are conditions which should be noted but do not affect the numerical grade. The special grades “Flint” and “Flint and Dent” denote amounts of flint corn in the sample. Flint corn is a different subspecies of corn with hard starch rather than soft starch as in dent corn. Infested is the condition of live weevils or grain-damaging insects in the grain.

References:

- Corn Kernel Damage #216
  Contact: Oklahoma State University phone (405) 744-6082
- United States Department of Agriculture, Federal Grain Inspection Service*. The Official Grain Standards of the United States Federal Grain Inspection Handbook.
- Now known as Grain Inspectors, Packers, and Stockyard Administration (GIPSA)

Grades and Grade Requirements for Corn

Grade	Minimum Test Weight Per Bushel	Maximum limits of — Damaged Kernels: Total	Damaged Kernels: Heat-damaged Kernels	Broken Corn and Foreign Material
	lbs.	%	%	%
U.S. No. 1	56.0	3.0	0.1	2.0
U.S. No. 2	54.0	5.0	0.2	3.0
U.S. No. 3	52.0	7.0	0.5	4.0
U.S. No. 4	49.0	10.0	1.0	5.0
U.S. No. 5	46.0	15.0	3.0	7.0

U.S. Sample Grade:

U.S. Sample Grade shall be corn which:

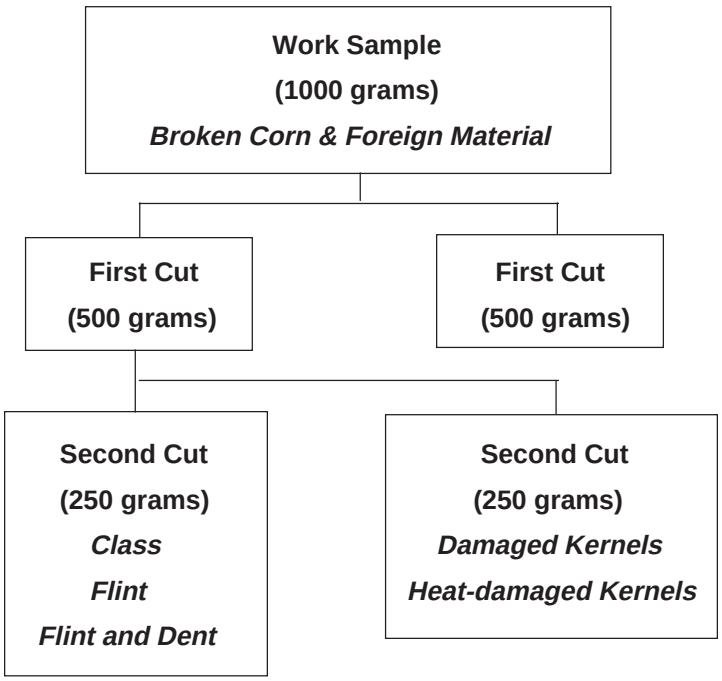
a) Does not meet the requirements for the grades U.S. Nos. 1, 2, 3, 4, or 5; or

b) In a 1,000 gram sample, contains 8 or more stones which have an aggregated weight in excess of 0.20 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (Crotalaria ssp.), 2 or more castor beans (Ricinus communis), 8 or more cockleburs, 4 or more particles of an unknown foreign substance(s), or a commonly recognized harmful or toxic substance(s), or animal filth in excess of 0.20 percent; or

c) Has a musty, sour, or commercially objectionable foreign odor; or

d) Is heating or otherwise of distinctly low quality.

Flow Chart Illustrating the Progression of Corn Separations



Corn Moisture Conversion Table

The following chart shows the number of pounds of corn at various moisture levels required to make 1 bushel. (One standard bushel of shelled corn = 56 lbs. at 15.5% moisture, the maximum permitted for U.S. No. 2 corn.)

The table gives pounds per bushel for moisture contents ranging from 11 to 36%. For weights at moisture levels below 11 and above 36%, use the following equation:

$$\text{Lb./bu.} = \frac{47.32}{(100 - \%\ \text{water})} \times 100$$

The figure 47.32 represents pounds of dry matter in a standard bushel of shelled yellow corn.

Pct. moisture	Lb./bu.	Pct. moisture	Lb./bu.	Pct. moisture	Lb./bu.	Pct. moistute	Lb./bu.	Pct. moisture	Lb./bu.
11.0	53.17	16.0	56.33	21.0	59.90	26.0	63.95	31.0	68.58
.1	53.23	.1	56.40	.1	59.98	.1	64.04	.1	68.68
.2	53.29	.2	56.47	.2	60.05	.2	64.12	.2	68.78
.3	53.35	.3	56.53	.3	60.13	.3	64.21	.3	68.88
.4	53.41	.4	56.60	.4	60.21	.4	64.30	.4	68.98
.5	53.47	.5	56.67	.5	60.29	.5	64.39	.5	69.09
.6	53.53	.6	56.74	.6	60.36	.6	64.47	.6	69.19
.7	53.59	.7	56.81	.7	60.44	.7	64.56	.7	69.29
.8	53.65	.8	56.87	.8	60.52	.8	64.65	.8	69.39
.9	53.71	.9	56.94	.9	60.59	.9	64.73	.9	69.49
12.0	53.77	17.0	57.01	22.0	60.67	27.0	64.82	32.0	69.59
.1	53.83	.1	57.08	.1	60.75	.1	64.91	.1	69.69
.2	53.89	.2	57.15	.2	60.83	.2	65.00	.2	69.80
.3	53.96	.3	57.22	.3	60.90	.3	65.09	.3	69.90
.4	54.02	.4	57.29	.4	60.98	.4	65.18	.4	70.01
.5	54.08	.5	57.36	.5	61.06	.5	65.27	.5	70.11
.6	54.14	.6	57.43	.6	61.14	.6	65.36	.6	70.21
.7	54.20	.7	57.50	.7	61.22	.7	65.45	.7	70.32
.8	54.27	.8	57.57	.8	61.29	.8	65.54	.8	70.42
.9	54.33	.9	57.64	.9	61.37	.9	65.63	.9	70.53
13.0	54.39	18.0	57.71	23.0	61.45	28.0	65.72	33.0	70.63
.1	54.45	.1	57.78	.1	61.53	.1	65.81	.1	70.74
.2	54.52	.2	57.85	.2	61.61	.2	65.91	.2	70.84
.3	54.58	.3	57.92	.3	61.69	.3	66.00	.3	70.95
.4	54.64	.4	57.99	.4	61.77	.4	66.09	.4	71.06
.5	54.71	.5	58.07	.5	61.86	.5	66.19	.5	71.17
.6	54.77	.6	58.14	.6	61.94	.6	66.28	.6	71.27
.7	54.83	.7	58.35	.7	62.02	.7	66.37	.7	71.38
.8	54.89	.8	58.28	.8	62.10	.8	66.46	.8	71.49
.9	54.96	.9	58.35	.9	62.18	.9	66.56	.9	71.59
14.0	55.02	19.0	58.42	24.0	62.26	29.0	66.65	34.0	71.70
.1	55.09	.1	58.49	.1	62.34	.1	66.75	.1	71.81
.2	55.15	.2	58.57	.2	62.43	.2	66.84	.2	71.92
.3	55.22	.3	58.64	.3	62.51	.3	66.94	.3	72.03
.4	55.28	.4	58.71	.4	62.59	.4	67.03	.4	72.14
.5	55.35	.5	58.78	.5	62.68	.5	67.13	.5	72.25
.6	55.41	.6	58.86	.6	62.76	.6	67.22	.6	72.36
.7	55.48	.7	58.93	.7	62.84	.7	67.32	.7	72.47
.8	55.54	.8	59.00	.8	62.92	.8	67.41	.8	72.58
.9	55.61	.9	59.08	.9	63.01	.9	67.51	.9	72.69
15.0	55.67	20.0	59.15	25.0	63.09	30.0	67.60	35.0	72.80
.1	55.74	.1	59.23	.1	63.17	.1	67.70	.1	72.91
.2	55.80	.2	59.30	.2	63.26	.2	67.80	.2	73.03
.3	55.87	.3	59.38	.3	63.34	.3	67.90	.3	73.14
.4	55.93	.4	59.45	.4	63.43	.4	67.99	.4	73.26
.5	56.00	.5	59.53	.5	63.52	.5	68.09	.5	73.37
.6	56.07	.6	59.60	.6	63.61	.6	68.19	.6	73.48
.7	56.13	.7	59.68	.7	63.69	.7	68.29	.7	73.60
.8	56.20	.8	59.75	.8	63.78	.8	68.38	.8	73.71
.9	56.26	.9	59.83	.9	63.86	.9	68.48	.9	73.82

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