



**United States
Department of
Agriculture**

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Marketing
Service

Fruit and
Vegetable
Division

Processed
Products
Branch

United States Standards for Grades of Canned Whole Kernel (Whole Grain) Corn

Effective December 8, 1999

This is the 5th issue, as amended, of the United States Standards for Grades of Canned Whole Kernel (Whole Grain) Corn, announced as a Notice in the **FEDERAL REGISTER** of November 8, 1999 (64 FR 215) to become effective December 8, 1999. This issue supersedes the 4th issue, which has been in effect since July 1, 1957.

Voluntary U.S. grade standards are issued under the authority of the Agricultural Marketing Act of 1946, which provides for the development of official U.S. grades to designate different levels of quality. These grade standards are available for use by producers, suppliers, buyers, and consumers. As in the case of other standards for grades of processed fruits and vegetables, these standards are designed to facilitate orderly marketing by providing a convenient basis for buying and selling, for establishing quality control programs, and for determining loan values.

The standards also serve as a basis for the inspection and grading of commodities by the Federal inspection service, the only activity authorized to approve the designation of U.S. grades as referenced in the standards, as provided under the Agricultural Marketing Act of 1946. This service, available as on-line (in-plant) or lot inspection and grading of all processed fruit and vegetable products, is offered to interested parties, upon application, on a fee-for-service basis. The verification of some specific recommendations, requirements, or tolerances contained in the standards can be accomplished only by the use of on-line inspection procedures. In all instances, a grade can be assigned based on final product factors or characteristics.

In addition to the U.S. grade standards, grading manuals or instructions for inspection of several processed fruits and vegetables are available upon request for a nominal fee. These manuals or instructions contain detailed interpretations of the grade standards and provide step-by-step procedures for grading the product.

Grade standards are issued by the Department after careful consideration of all data and views submitted, and the Department welcomes suggestions which might aid in improving the standards in future revisions. Comments may be submitted to, and copies of standards and grading manuals obtained from:

Chief, Processed Products Branch
Fruit and Vegetable Programs, AMS
U.S. Department of Agriculture
STOP 0247, P.O. Box 96456, Rm. 0709, So. Bldg.
Washington, D.C. 20090-6456

United States Standards for Grades of
Canned Whole Kernel (Whole Grain) Corn

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Authority: Agricultural marketing Act of 1946, Sec. 203, 205, 60 Stat. 1087, as amended, 1090, as amended (7 U.S.C. 1622, 1624).

Note: Compliance with the provisions of these standards shall not excuse failure to comply with the provisions of the Federal Food, Drug, and Cosmetic Act, or with applicable State laws and regulations.

§52.881 Product description.

Canned whole kernel (whole grain) corn, including vacuum packed corn, means the canned product properly prepared from clean, sound, succulent kernels of sweet corn as defined in the Standard of Identity for Canned Corn (21 CFR 155.130) issued pursuant to the Federal Food, Drug, and Cosmetic Act.

§52.882 Varietal types of canned whole kernel corn.

- (a) **Conventional** means kernels of sweet corn that convert sugars to starch by going through distinct stages of maturity-- milk, cream, then dough stages.
- (b) **Supersweet (shrunk 2)** means kernels (or grains) of corn that provide higher naturally occurring sugar, and/or crisper texture (may be yellow, white or combination of each) typical for the variety. These varieties may be slightly darker in color, and some varieties have slightly tougher pericarp (kernel skin) than conventional sweet corn.

§52.883 Color types of canned whole kernel corn.

- (a) **Golden (or yellow)** means kernels (or grains) of corn that are predominately golden (or yellow) and typical for the variety.
- (b) **White** means kernels (or grains) of corn that are predominately light cream in color and typical for the variety.
- (c) **Combination yellow and white** means any combination of the above varieties and color types or a bi-colored variety.

§52.884 Definition of terms.

- (a) **Acceptable quality level (AQL)** means the maximum percent of defective units or the maximum number of defects per hundred units of product that, for the purpose of acceptance sampling, can be considered satisfactory as a process average.
- (b) **Appearance.**
 - (1) **Good appearance** means the sample unit has a practically uniform color typical of the varietal or color type.
 - (2) **Reasonably good appearance** means the sample unit has a

reasonably uniform color typical of the varietal or color type.

- (3) **Fairly good appearance** means the sample unit has a fairly uniform color typical of the varietal or color type. Fairly good appearance limits the "Lot Grade" to Grade B.
- (c) **Chaff** means bits of internal and external kernel parts.
- (d) **Cob** means tough cellulose material that the kernels of corn grow upon. A portion of cob material means a piece of cob that may or may not be attached to kernel(s) of corn (**corn kernels are removed from cob tissue before making measurements**).
- (e) **Cut** means the degree of smoothness of the cut surface of the kernels, uniformity of depth of cut, chaff, and the degree of freedom from adhering cob tissue.
 - (1) **Well cut** means the product is more than slightly affected by the presence of ragged cut kernels, torn kernels, chaff, and irregular cut kernels.
 - (2) **Reasonably well cut** means the product is not materially affected by the presence of ragged cut kernels, torn kernels and irregular cut kernels.
 - (3) **Fairly well cut** means the product is not seriously affected by the presence of ragged cut kernels, torn kernels, chaff, and irregular cut kernels.
- (f) **Damaged kernel** means any kernel affected by insect injury, discoloration, pathological injury, or by other means to the extent that the appearance or eating quality is materially affected. **Seriously damaged kernel** means any kernel affected by insect injury, discoloration, pathological injury, or by other means to the extent that the appearance or eating quality is seriously affected.
- (g) **Defect** means any nonconformance of a unit of product from a specified requirement of a single quality characteristic.
- (h) **Extraneous vegetable material (EVM)** means any harmless vegetable material, to include, but not limited to: cob; husk; shank and stalk; or silk (**any color**).

- (i) **Flavor and odor** refers to the palatability of the product. The natural flavor of the sweet corn for the varietal type and/or the effect of added natural sweeteners, salt, or other suitable optional ingredients (Standard of Identity 155.130) are considered in evaluating this factor.
 - (1) **Good flavor and odor** means the product has a good characteristic flavor and odor for the varietal type of canned sweet corn and is free from objectionable flavors and odors. The number of sample units in a lot that have "fairly good flavor" shall not exceed the applicable acceptance number specified in the sample plan contained in the "Regulations Governing Inspection and Certification of Processed Fruits and Vegetables and Related Products."
 - (2) **Fairly good flavor and odor** means the product may be lacking in good flavor and odor, may have a flavor typical of very mature corn, may have an overcooked flavor or an atypical flavor caused by processing or post-harvest conditions, but is free from objectionable flavors and odors.
- (j) **Husk** means the fibrous vegetable sheath that surrounds the ear of the corn.
- (k) **Pulled kernel** means a kernel of corn that has been removed from the cob (with cob tissue attached) such that the appearance or eating quality is materially affected as shown in examples 5, 6, and 7 of the USDA Photo-Guide for Classifying "Cut" and "Pulled" Kernels in Canned and Frozen Whole Kernel Corn.
- (l) **Sample unit** means the amount of product specified to be used for grading. For appearance, cut, flavor and odor, tenderness and maturity, and varietal characteristics this includes the entire drained contents of the container. For grading EVM this includes 850 grams (30 oz drained weight); for seriously damaged kernels, damaged kernels and pulled kernels the sample unit is 1000 kernels. The sample unit may be:
 - (1) The entire contents of a container;
 - (2) A portion of the contents of a container; or
 - (3) A combination of the contents of two or more containers.
- (m) **Shank** means the tough stem that attaches the ear of corn to the stalk. Shank material includes the tough basal portion that is attached to the husk.

- (n) **Silk** means the silky hair-like filament of any color.
- (o) **Stalk** means the tough woody main support stem of the corn plant.
- (p) **Tolerance** means the percentage of defective units allowed for a specific sample size.
- (q) **Tenderness and maturity** means tender in texture with characteristics typical of early stage of development of the kernels for the varietal type(s).

(1) Good tenderness and maturity.

For conventional sweet corn—corn is tender with a cream texture a pericarp that chews easily. The kernels are full and tender, typical of the milk and early cream stage of maturity. There are three levels of quality within "good tenderness and maturity": very tender, tender, moderately tender.

For supersweet corn—corn is crisp and may have slightly tough pericarp, compact internal flesh, that is associated with plump or full kernels. There are three levels of quality within "good tenderness and maturity": very tender and crisp; tender and crisp; and moderately tender and crisp.

(2) Reasonably good tenderness and maturity.

For conventional sweet corn--is typical of the cream stage of maturity but lacks the attributes for "good tenderness and maturity." Some pericarp residue may be evident upon chewing. There are two levels of quality within "reasonably good tenderness and maturity": cream stage and moderate cream stage.

For supersweet corn--is corn that lacks tenderness and may be moderately dry. Kernels may have a reasonably tough pericarp and occasionally are dented. There are two levels of quality within "reasonably good tenderness and maturity": not crisp, not moist; and not crisp, moderately dry, and may include occasional dented kernels. The number of sample units in a lot that fail to meet "reasonably good tenderness and maturity" shall not exceed the applicable acceptance number specified in the sample plan contained in the "Regulations Governing Inspection and Certification of Processed Fruits and Vegetables and Related Products" (Reference 109-A-1, 52.38).

(3) Fairly tough.

For conventional sweet corn--is corn that is in the dough stage "dry and chewy". Kernels may be dented, but not woody. Pericarp may be tough but not very tough.

For supersweet corn--is corn that is dry, chewy corn, with tough but not very tough pericarp. The number of sample units in a lot that fail to meet "tough" shall not exceed the applicable acceptance number specified in the sample plan contained in the "Regulations Governing Inspection and Certification of Processed Fruits and Vegetables and Related Products."

(r) Unit means a kernel of corn or a significant portion thereof.

§52.885 Recommended fill of container.

The standard for fill of container is not incorporated in the grades of the finished product, since fill of container, as such, is not a factor of quality for the purposes of these grades. It is recommended that each container of canned corn be filled as full as practicable without impairment of quality and that, except for vacuum pack, the product and packing medium occupy not less than 90 percent of the capacity of the container. The product is considered "Vacuum Packed" when the liquid in the container [as outlined in 21 CFR 155.130 (a)] is not more than 20 percent of the net weight and the container is closed under conditions creating a high vacuum.

§52.886 Recommended minimum drained weight.

The minimum drained weight recommendations found in the Grading Manual for Canned Whole Kernel Corn are not incorporated in the grades of the finished product, since drained weight, as such, is not a factor of quality for the purpose of these grades.

§52.887 Grades.

(a) U.S. Grade A is the quality of canned corn that:

(1) Meets the following prerequisites (Table I) in which the canned corn:

(i) Has similar varietal characteristics;

(ii) Has a good appearance;

- (iii) Is well cut;
- (iv) Has a good flavor and odor; and
- (v) Has good tenderness and maturity for the varietal type.

(2) Is within the limits for defects as specified in Tables II and III as applicable for the varietal type.

(b) U.S. Grade B is the quality of canned corn that:

(1) Meets the following prerequisites (Table I) in which the canned corn:

- (i) Has similar varietal characteristics;
- (ii) Has a reasonably good appearance;
- (iii) Is reasonably well cut;
- (iv) Has a good flavor and odor; and
- (v) Has reasonably good tenderness and maturity for the varietal type.

(2) Is within the limits for defects as specified in Tables II and III as applicable for the varietal type.

(c) U.S. Grade C is the quality of canned corn that:

(1) Meets the following prerequisites (Table I) in which the canned corn:

- (i) Has similar varietal characteristics;
- (ii) Has a fairly good appearance;
- (iii) Is fairly well cut;
- (iv) Has a fairly good flavor and odor; and

- (v) Is fairly tough for the varietal type.
- (2) Is within the limits for defects as specified in Tables II and III as applicable for the varietal type.
- (d) **Substandard** is the quality of canned corn that fails to meet the requirements of U.S. Grade C.

§52.888 Factors of quality.

The grade of canned corn is based on requirements for the following quality factors:

- (a) Prerequisite quality factors:
 - (1) Varietal characteristics;
 - (2) Appearance;
 - (3) Cut;
 - (4) Flavor and odor; and
 - (5) Tenderness and maturity.
- (b) Classified quality factors:
 - (1) Extraneous vegetable material (EVM);
 - (2) Seriously damaged kernels;
 - (3) Damaged kernels; and
 - (4) Pulled kernels.

§52.889 Allowances for defects.

**TABLE I
PREREQUISITES REQUIREMENTS**

PREREQUISITE:	GRADE A	GRADE B	GRADE C
Varietal characteristics	Similar	Similar	Similar
Appearance	Good	Reasonably good	Fairly good
Cut	Well	Reasonably well	Fairly well
Flavor and odor	Good	Good	Fairly good
Tenderness and maturity	Good	Reasonably good	Fairly tough

**TABLE II
AQL's, TOLERANCES, AND ACCEPTANCE NUMBERS FOR EVM
BASED ON 850 GRAMS (30.0 ounces)**

Sample Units x Sample Unit Size			1x	3x	6x	13x	21x	29x
			850	850	850	850	850	850
Units of Product in Grams			850	2550	5100	11050	17850	24650
Extraneous Vegetable Material (EVM)	TOL ^{1/}	AQL	Acceptance Numbers					
GRADE A								
Cob each cc (0.061 cu in) <u>2/</u>	1.41	1.25	0.80	2.05	3.85	7.85	12.35	16.85
Husk each cm ² (0.155 sq. in) <u>2/</u>	0.57	0.47	7	17	32	64	99	133
Silk, each 2.54 cm, recorded in inches	3.5	3.2	36	96	184	384	611	835
GRADE B								
Cob each cc (0.061 cu in) <u>2/</u>	3.5	3.2	1.8	4.8	9.2	19.2	30.6	41.8
Husk each cm ² (0.155 sq. in) <u>2/</u>	1.14	0.99	13	33	62	126	198	270
Silk, each 2.54 cm, recorded in inches	7.0	6.6	68	189	367	774	1235	1693
GRADE C								
Cob each cc (0.061 cu in) <u>2/</u>	4.94	4.6	2.45	6.75	13.0	27.3	43.4	59.5
Husk each cm ² (0.155 sq. in) <u>2/</u>	1.71	1.5	18	48	91	187	244	402
Silk, each 2.54 cm, recorded in inches	24.5	23.8	222	642	1264	2703	4342	5976

^{1/} Tolerance for cob is based on each 0.05 cc; for husk--each cm²; and silk--each 9 cm at 11050 grams.

^{2/} Corn stalk and shank: If hard and tough, count as cob; if less severe, count as husk.

**TABLE III
AQL's, TOLERANCES, AND ACCEPTANCE NUMBERS FOR OTHER DEFECTS ^{1/}**

Sample Units x Sample Unit Size			1x 1000	3x 1000	6x 1000	13x 1000	21x 1000	29x 1000
Units of Product by Count			1000	3000	6000	13000	21000	29000
Defects Other than EVM	TOL. 1/	AQL	Acceptance Numbers					
GRADE A								
Seriously damaged kernels	0.08	.047	1	3	5	10	15	20
Damaged kernels	0.25	.192	4	10	17	33	51	68
Pulled kernels	0.25	.192	4	10	17	33	51	68
GRADE B								
Seriously damaged kernels	0.25	.192	4	10	17	33	51	68
Damaged kernels	0.50	.409	7	18	33	65	101	136
Pulled kernels	0.42	0.34	6	15	28	55	85	115
GRADE C								
Seriously damaged kernels	0.42	0.34	6	15	28	55	85	115
Damaged kernels	1.00	.867	13	34	64	130	204	277
Pulled kernels	0.67	.562	9	23	43	87	136	184

^{1/} Based on 1000 x 13 (13,000) kernels.

§52.890 Sample size.

The sample size used to determine whether the requirements of these standards are met shall be as specified in the sampling plans and procedures in the "Regulations Governing Inspection and Certification of Processed Fruits and Vegetables, Processed Products Thereof, and Certain Other Processed Food Products" (7 CFR 52.1 through 52.83).

§52.891 Quality requirements.

- (a) A lot of canned corn is considered as meeting the requirements for quality if:
 - (1) The prerequisite requirements specified in Section 52.887 are met; and
 - (2) None of the allowances for the individual quality factors specified in Section 52.889

in Table II and III, as applicable are exceeded.

- (b)** Single sample unit. Each unofficial sample unit submitted for quality evaluation will be treated individually and is considered as meeting the requirements for quality if:
 - (1)** The prerequisites requirements specified in Section 52.887 are met;
 - (2)** The acceptable quality levels (AQL's) in Section 52.889 in Table II and III, as applicable for the style are not exceeded.

Dated:

/s/
Robert C. Keeney
Deputy Administrator
Fruit and Vegetable Programs