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# Official Grain Grading Guide

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## 17. Corn

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## Determination of dockage

### Definitions

Dockage is only assessed when producers deliver corn to country elevators in eastern Canada. Dockage is assessed to the nearest 0.1%. In all other locations, this material is called *Cracked corn and foreign material (CCFM)* and is a grading factor.

Dockage is defined under the Canada Grain Act as “any material intermixed with a parcel of grain, other than kernels of grain of a standard of quality fixed by or under this Act for a grade of that grain, that must and can be separated from the parcel of grain before that grade can be assigned to the grain.” Dockage is removed by following the cleaning procedures described in this section of the manual.

The sample as it arrives is referred to as the uncleaned or dirty sample. Its weight is the **gross weight** of the sample. Dockage is assessed on the gross weight of the sample.

### Dockage not reported

- ▲ **Important:** Dockage is not reported when corn is graded
  - *Corn, Sample CE Account Fireburnt*
  - *Corn, Sample Salvage*
  - *Corn, Sample Condemned*

### Normal cleaning procedures: Carter dockage tester

- ▲ **Important:** Wear gloves and a mask to handle any sample which you suspect may contain hazardous substances.

Assess dockage before assessing test weight.

1. Set up the Carter dockage tester as follows:

Feed control	# 10
Air control	off
Riddle	none
Top sieve	No. 12 round-hole (moisture 25.0% or less) No. 14 round-hole (moisture over 25.0%)
Centre sieve	blank tray
Bottom sieve	none
Sieve cleaner	off

2. Using a Boerner-type divider, divide the uncleaned sample to obtain a representative portion.
  - Official samples should be at least 900 g.
  - Unofficial samples should be at least 750 g.
3. Turn on the Carter dockage tester.

4. Pour the sample into the hopper.
5. After the sample has passed through the machine, turn off the Carter dockage tester.
6. Remove the sample pans containing the corn and broken corn.
7. Determine dockage, using the list under *Composition of dockage*.

#### **Normal cleaning procedures: manual procedures**

Manual procedures for normal cleaning of corn require

- No. 12 round-hole sieve for corn with 25% moisture or less
  - No. 14 round-hole sieve for corn over 25% moisture
1. Using a Boerner-type divider, divide the uncleaned sample to obtain a representative portion.
    - Official samples should be at least 900 g.
    - Unofficial samples should be at least 750 g.
  2. Sieve approximately 250 g at a time on the appropriate hand sieve until all possible material has fallen through the sieve.
  3. Handpick material remaining on top of the sieve as described under *Composition of dockage*.

#### **Composition of dockage**

- All material which passes through the No. 12 or No. 14 round-hole sieve
- All foreign material and pieces of cob handpicked from the sample, excluding stones

## Estimating test weight of well-matured corn after drying

**Note:** Test weight is determined on corn prior to removal of cracked corn and foreign material. At country elevators in eastern Canada test weight is determined after the removal of dockage.

Corn samples that contain a high percentage of moisture typically show an increase in test weight after drying. Use the following table to predict the test weight of well-matured corn before drying.

- ▲ **Important:** This is only a guide, and works only with well matured corn. Samples should be checked yearly to ensure that the formula applies for that crop condition.

Moisture range	Amount to add	
	kg/hL	g/0.5 L
15.8 - 16.4	0.5	2.6
16.5 - 16.9	1.0	5.2
17.0 - 17.3	2.0	10.5
17.4 - 17.6	2.1	11.0
17.7 - 17.9	2.2	11.5
18.0 - 18.3	2.3	12.0
18.4 - 18.6	2.4	12.5
18.7 - 18.9	2.5	13.0

1. Find the moisture range for the test weight of the sample.
2. Add the amount for that moisture range in the appropriate units, either kg/hl or g/l.

- ▲ **Important:** Corn samples are not to be downgraded on the basis of an “estimated” test weight. Questionable samples must be dried by exposure and then have the test weight determined.

For example,

The moisture for the tested sample is 17.5%, and the test weight is in kg/hl.

Moisture range	Amount to add	
	kg/hL	g/0.5 L
17.4 - 17.6	2.1	11.0

Add 2.1 to the test weight in kg/hl.

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## Grading

### Important definitions

#### Net weight of sample

The sample after cleaning and removal of dockage is referred to as the cleaned sample. Its weight is the net weight of the sample. Percentages by weight for grading refer to percentages of the net weight.

#### Kernel counts (K)

A kernel count is the number of kernel-sized pieces of stones in a sample of corn.

- To do kernel counts, you must have 500 grams of cleaned sample.
- All grading is done on representative portions divided down from the cleaned sample using a Boerner-type divider.

#### Hazardous substances in samples

Wear gloves and a mask to handle any samples that you suspect may contain hazardous substances. Hazardous substances are defined in the Regulations as “any pesticide, herbicide or desiccant.”

#### Representative portions for grading

All grading is done on representative portions divided down from the cleaned sample, using a Boerner-type divider.

When the grading factor is . . .	Then use . . .
Normal	Optimum portion size
Severe	Minimum portion size or more (do not use less)

Values in this table represent a range of recommended portion sizes.

#### Representative portion of corn for grading, grams

Grading factor	Minimum	Optimum	Export
Caramelized kernels	100	500	500
Classes	100	working sample	working sample
Cracked corn and foreign material	working sample	working sample	working sample
Damage	100	500	500
Excreta	working sample	working sample	working sample
Fireburnt	working sample	working sample	working sample
Heated and rotted	100	500	working sample
Odour	working sample	working sample	working sample
Stones	500	working sample	working sample

## Grading factors

### Blue-eye mould

Germs of kernels appear dark blue with mould, or there may be just a visible mouldy blue streak under the hull of the germ. In the second case, peel back the hull from the germ to examine the germ.

Blue-eye mould is included in the tolerance for *Damage*.

#### Representative portion for analysis

Minimum—100 g

Optimum—500 g

Export—500 g

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### Caramelized kernels

Caramelized kernels are kernels that were very immature when dried at a high temperature in a dryer, and the heat has turned the kernel to a scorched colour similar to that of heated kernels. The outer hull of the kernel may be peeled off showing a slightly damaged kernel inside. These kernels are classed as *Damaged*.

#### Representative portion for analysis

Minimum—100 g

Optimum—500 g

Export—500 g

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## Classes

Corn is classed as yellow, white, or mixed. The class forms part of the grade name; for example, *Corn, Sample CW Yellow Account Heated*.

Samples of yellow and white corn containing less than 95.0% of one class are designated *Mixed*; for example, *Corn No. 1 CE Mixed*.

#### Representative portion for analysis

Minimum—100 g

Optimum—working  
sample

Export—working  
sample

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### Contaminated grain

- ▲ **Important:** Wear gloves and a mask to handle any sample that is suspected of containing contaminated grain.

Contaminated is defined in the “*Canada Grain Act*” as; “Contaminated means, in respect of grain, containing any substance in sufficient quantity that the grain is unfit for consumption by persons or animals or is adulterated within the meaning of the regulations made pursuant to sections B.01.046(1), B.15.001 and B.15.002(1) of the *Food and Drugs Act*.”

Samples deemed to be contaminated by the Grain Research Laboratory in consultation with the Chief Grain Inspector for Canada are graded *Corn, Sample Condemned*.



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### Cracked corn and foreign material (CCFM)

Cracked corn and foreign material includes any of the following:

- All material including kernels and pieces of kernels of corn or any other grains which pass through a No. 12 round-hole sieve or, for samples with a moisture level over 25.0%, through the No. 14 round-hole sieve
- All foreign material other than stones handpicked from the sample, including pieces of cobs that were not removed by sieving

#### Representative portion for analysis

Minimum—working  
sample

Optimum—working  
sample

Export—working  
sample

#### Procedures

▲ **Important:** Follow procedures for assessing dockage.

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### Damage (DMG)

Damaged kernels include whole kernels or pieces of kernels which are

- Affected by blue-eye mould and other types of moulds
- Sprouted
- Ground-damaged
- Weathered
- Diseased
- Frosted
- Scorched, from a drier
- Heated, naturally, or from a drier, or caramelized
- Rotted

#### Representative portion for analysis

Minimum—100 g

Optimum—500 g

Export—500 g

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### Earth pellets

- Hard earth pellets are pellets that do not crumble under light pressure.  
See *Stones*.
  - Soft earth pellets are pellets that crumble under light pressure.  
See *Cracked corn and foreign material*.
- 

### Excreta (EXCR)

▲ **Important:** Wear gloves and a mask to handle any samples that you suspect may contain excreta.

#### Representative portion for analysis

Minimum—working  
sample

Optimum—working  
sample

Export—working  
sample

#### Procedures

Samples of corn containing excreta are graded on a comparable basis using tolerances established for excreta in other grains.

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**Fertilizer pellets (FERT PLTS)**

Fertilizer pellets are typically either small, round and white or irregular shaped and pink or red. Fertilizer pellets are not considered a hazardous substance however there is no visible means of assuring that material resembling fertilizer pellets is not some other contaminant.

**Representative portion for analysis**

Minimum—working  
sample

Optimum—working  
sample

Export—working  
sample

**Procedures**

- Handpick any fertilizer pellets and determine the concentration basis the net working sample.
- Fertilizer pellets are assessed as stones when the concentration does not exceed 1.0% of the net sample weight.
- Samples containing fertilizer pellets in excess of 1.0% of the net sample weight are graded *Corn, Held IP Suspect Contaminated Grain*.

**Note:** Canadian Grain Commission personnel should refer to ISO national work instruction “*Suspect Contaminated Grain, Handling Procedures*” for procedures to be followed when handling samples containing fertilizer pellets.

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**Fireburnt (FBNT)**

Fireburnt kernels are kernels charred or scorched by fire. A cross-section of a fireburnt kernel resembles charcoal with numerous air holes. The air holes result in a low weight kernel which crumbles easily under pressure.

**Representative portion for analysis**

Minimum—working  
sample

Optimum—working  
sample

Export—working  
sample

**Procedures**

Samples of corn containing fireburnt kernels are graded *Corn, Sample CW/CE (class) Account /Fireburnt*.

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**Foreign material (FM)**

See *Cracked corn and foreign material (CCFM)*.

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## Heated (HTD)

Heated kernels have at least one of the following characteristics:

- Whole kernels or pieces of kernels which range in colour from amber to dark brown over the entire kernel
- Kernels which are totally discoloured by fermentation and show no natural colour on the crowns or dorsals, or both
- The germ of the kernel is amber to dark brown and is severely puffed in the germ area when heated in a drier
- A kernel of any other grain that is heated

If kernels exhibit none of the above characteristics, but are not whole or sound, they are classed as *Damaged*.

**Note:** Cracked corn and foreign material that is heated is included with heated corn for grade assessment.

### Representative portion for analysis

Minimum—100 g

Optimum—500 g

Export—500 g

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## Odour (ODOR)

There is no numeric tolerance for odour. Consider

- The basic quality of the sample
- The type and degree of the odour
- The presence of visible residue causing the odour

Grains grading No. 1 through 4 must be cool and sweet. Corn grading No. 5 may have a slight odour associated with the low quality, but the odour cannot be sour or musty.

### Representative portion for analysis

Minimum—working  
sample

Optimum—working  
sample

Export—working  
sample

If odour is the grade determinant and there is . . .	Then the grade is . . .
An excessive objectionable odour not associated with the quality of the grain, but not heated or fireburnt	<i>Corn, Sample CW/CE Account Odour</i>
An excessive heated odour	<i>Corn, Sample CW/CE Account Heated</i>
An excessive fireburnt odour	<i>Corn, Sample CW/CE Account Fireburnt</i>

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## Rotted (ROT)

Rotted kernels are whole kernels or pieces of kernels which are visibly in advanced stages of decomposition and feel spongy under pressure. Rotted kernels are included in the percentage of heated kernels for grade assessment.

### Representative portion for analysis

Minimum—100 g

Optimum—500 g

Export—500 g

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## Stones (STNS)

Stones are hard shale, coal, hard earth pellets, and any other non toxic materials of similar consistency. Fertilizer pellets are assessed as stones when constituting 1.0% or less of the net sample weight. (See *Fertilizer pellets* for specific procedures to be followed when samples contain fertilizer pellets.)

### Representative portion for analysis

Minimum—500 g

Optimum—1000 g

Export—1000 g

### Procedures

1. Handpick stones from a representative portion of the cleaned sample.
  2. Determine stone concentration in the net sample.
- In western Canada samples of grain containing stones in excess of “basic grade” tolerances, up to 2.5% are graded *Corn, Rejected “basic grade” Account Stones*. The “basic grade” refers to a grade established in the Canada Grain Regulations (grades listed in the first column in grade determinant tables) that would have been assigned to the sample if it contained no stones.
  - In eastern Canada samples of grain containing stones in excess of grade tolerances are degraded to lower grades. Samples containing stones in excess of the tolerance of the lowest grade established by regulation up to 2.5% are graded *Corn, Sample CE (class) Account Stones*.
  - In western and eastern Canada grain containing more than 2.5% stones is graded *Corn, Sample Salvage*.

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Examples: Western Canada

Excerpt from grade determinant tables for  
Corn, Canada Western, White, Yellow or Mixed

Grade name	Stones
No. 1 CW	3K
No. 2 CW	3K
No. 3 CW	3K
No. 4 CW	3K
No. 5 CW	3K

K Number of kernel-sized pieces in 500 g

Basic grade:..... *Corn, No. 2 CW Yellow*

Reason for basic grade:..... 3.0% Cracked corn and foreign material

If the above sample contained	Grade in Western Canada
10K stones	<i>Corn, Rejected No. 2 CW Yellow Account Stones</i>
3.0% stones	<i>Corn, Sample Salvage</i>

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Examples: Eastern Canada

Excerpt from grade determinants table for  
Corn, Canada Eastern, White, Yellow or Mixed

Grade name	Stones
No. 1 CE	3K
No. 2 CE	3K
No. 3 CE	3K
No. 4 CE	3K
No. 5 CE	3K

K Number of kernel-sized pieces in 500 g

Basic grade:..... *Corn, No. 2 CE Yellow*

Reason for basic grade:..... 3.0% Cracked corn and foreign material

If the above sample contained	Grade in Eastern Canada
10K stones	<i>Corn, Sample CE Yellow Account Stones</i>
3.0% stones	<i>Corn, Sample Salvage</i>

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## Treated seed and other chemical substances

### Treated seed

Treated seed is grain that has been coated with an agricultural chemical for agronomic purposes. These seed dressings contain a dye to render the treated seed visually conspicuous. The colour of the dye varies depending upon the type of treatment and the type of grain. The current Canadian colour standards for pesticide seed treatments are: cereals—pink or red, canola—baby blue or green. Seed treated with an inoculant may have a green stain. The coatings or stains may appear greasy or powdery and surface area distribution ranges from tiny flecks to complete coverage.

### Other chemical substances

Other chemical substances refers to any chemical residues either adhering to the kernel or remaining in the sample and to samples having a chemical odour of any kind.

- ▲ **Important:** Wear gloves and a mask to handle any samples that you suspect may contain contaminated grain.

### Representative portion for analysis

Minimum—working  
sample

Optimum—working  
sample

Export—working  
sample

If a sample is suspected of being coated with a pesticide, desiccant, inoculant or if the sample contains evidence of any foreign chemical substance other than fertilizer pellets, the sample shall be graded *Corn, Held IP Suspect Contaminated Grain*.

**Note:** Canadian Grain Commission personnel should refer to ISO national work instruction “*Suspect Contaminated Grain, Handling Procedures*” for specific procedures to be followed when handling samples suspected of containing treated seed or other chemical substances.

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## Varieties

Corn is graded without reference to variety.

## Primary and export grade determinants table

### Corn, Canada Western/Canada Eastern Yellow, White or Mixed (CW/CE)

Grade name	Standard of quality		Damage		Stones	Cracked corn and foreign material %	Other classes %
	Minimum test weight kg/hL (g/0.5 L)	Degree of soundness	Heated %	Total %			
No. 1 CW/CE	68 (344)	Cool and sweet, uniform size	0.1	3	3K	2	5
No. 2 CW/CE	66 (333)	Cool and sweet	0.2	5	3K	3	5
No. 3 CW/CE	64 (322)	Cool and sweet	0.5	7	3K	5	5
No. 4 CW/CE	62 (311)	Cool and sweet	1	10	3K	7	5
No. 5 CW/CE	58 (290)	May have a slight odour, not sour or musty	3	15	3K	12	5
Grade, if No. 5 specs not met	<i>Corn, Sample CW/CE (class) Account Light Weight</i>		<i>Corn, Sample CW/CE (class) Account Heated</i>	<i>Corn, Sample CW/CE (class) Account Damaged</i>	<i>2.5% or less—Corn, Rejected (grade) (class) Account Stones or Corn, Sample CE (class) Account Stones Over 2.5%—Corn, Sample Salvage</i>	<i>50% or less—Corn Sample CW/CE (class) Account CCFM Over 50%—Sample Cracked Corn and Foreign Material</i>	<i>Over 5%—Use all other grading criteria and grade as Corn (grade) Mixed</i>

K Number of kernel-sized pieces in 500 g

Note: The colour is added to the grade name.

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## **Export shipments**

### **Grading**

Corn on export is graded in accordance with primary grade standards and specifications.

### **Cracked corn and foreign material (CCFM)**

Because breakage occurs during handling at terminal and transfer elevators, round down percentages by weight of CCFM to the nearest whole number only on officially sampled and inspected shipments from a transfer or terminal elevator.

For example, a sample containing 4.7% CCFM by weight is recorded as containing 4.0% CCFM for grading purposes only on officially sampled and inspected shipments from a transfer or terminal elevator.