DEPARTMENT OF GRAIN SCIENCE AND INDUSTRY

Wheat Grading Procedures

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Definition of Wheat

Grain that, before the removal of dockage, consists of 50 percent or more common wheat (*Triticum aestivum* L.), club wheat (*T.compactum* Host.), and durum wheat (*T.durum* Desf.) and not more than 10 percent of other grains for which standards have been established under the United States Grain Standards Act and that, after the removal of the dockage, contains 50 percent or more of whole kernels of one or more of these wheats.

Definitions of other terms

(a) **Classes.** There are eight classes for wheat: Durum wheat, Hard Red Spring wheat, Hard Red Winter wheat, Soft Red Winter wheat, Hard White wheat, Soft White wheat, Unclassed wheat, and Mixed wheat.

(1) **Durum wheat.** All varieties of white (amber) durum wheat. This class is divided into the following three subclasses:

(i) **Hard Amber Durum wheat.** Durum wheat with 75 percent or more of hard and vitreous kernels of amber color.

(ii) **Amber Durum wheat.** Durum wheat with 60 percent or more but less than 75 percent of hard and vitreous kernels of amber color.

(iii) **Durum wheat.** Durum wheat with less than 60 percent of hard and vitreous kernels of amber color.

(2) **Hard Red Spring wheat.** All varieties of Hard Red Spring wheat. This class is divided into the following three subclasses:

(i) **Dark Northern Spring wheat.** Hard Red Spring wheat with 75 percent or more of dark, hard, and vitreous kernels.

(ii) **Northern Spring wheat.** Hard Red Spring wheat with 25 percent or more but less than 75 percent of dark, hard, and vitreous kernels.

(iii) **Red Spring wheat.** Hard Red Spring wheat with less than 25 percent of dark, hard, and vitreous kernels.

(3) **Hard Red Winter wheat.** All varieties of Hard Red Winter wheat. There are no subclasses in this class.

(4) **Soft Red Winter wheat.** All varieties of Soft Red Winter wheat. There are no subclasses in this class.

(5) **Hard White wheat.** All hard endosperm white wheat varieties. There are no subclasses in this class.

(6) **Soft White wheat.** All soft endosperm white wheat varieties. This class is divided into the following three subclasses:

(i) **Soft White wheat.** Soft endosperm white wheat varieties which contain not more than 10 percent of white club wheat.

(ii) **White Club wheat.** Soft endosperm white club wheat containing not more than 10 percent of other soft white wheats.

(iii) **Western White wheat.** Soft white wheat containing more than 10 percent of white club wheat and more than 10 percent of other soft white wheats.

(7) **Unclassed wheat.** Any variety of wheat that is not classifiable under other criteria provided in the wheat standards. There are no subclasses in this class. This class includes any wheat which is other than red or white in color.

(8) **Mixed wheat.** Any mixture of wheat that consists of less than 90 percent of one class and more than 10 percent of one other class or a combination of classes that meet the definition of wheat.

(b) **Contrasting classes.** Contrasting classes are:

(1) Durum wheat, Hard White wheat, Soft White wheat, and Unclassed wheat in the classes Hard Red Spring wheat and Hard Red Winter wheat.
(2) Hard Red Spring wheat, Hard Red Winter wheat, Hard White wheat, Soft Red Winter wheat, Soft White wheat, and Unclassed wheat in the class Durum wheat.
(3) Durum wheat and Unclassed wheat in the class Soft Red Winter wheat.
(4) Durum wheat, Hard Red Spring wheat, Hard Red Winter wheat, Soft Red Winter wheat, and Unclassed wheat in the classes Hard White wheat and Soft White wheat.

(c) **Damaged kernels.** Kernels, pieces of wheat kernels, and other grains that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.

(d) **Defects.** Damaged kernels, foreign material, and shrunken and broken kernels. The sum of these three factors may not exceed the limit for the factor defects for each numerical grade.

(e) **Dockage.** All matter other than wheat that can be removed from the original sample by use of an approved device (an equivalent procedure using hand sieves is described on page 7) according to procedures prescribed in FGIS instructions. Also, underdeveloped, shriveled, and small pieces of wheat kernels removed in properly separating the material other than wheat and that cannot be recovered by properly re-screening or recleaning.

(f) **Foreign material.** All matter other than wheat that remains in the sample after the removal of dockage and shrunken and broken kernels. Determine the amount of foreign material in wheat by handpicking.

(g) **Heat-damaged kernels.** Kernels, pieces of wheat kernels, and other grains that are materially discolored and damaged by heat which remain in the sample after the removal of dockage and shrunken and broken kernels.

(h) **Other grains.** Barley, corn, cultivated buckwheat, einkorn, emmer, flaxseed, guar, hull-less barley, nongrain sorghum, oats, Polish wheat, popcorn, poulard wheat, rice, rye, safflower, sorghum, soybeans, spelt, sunflower seed, sweet corn, triticale, and wild oats.

(i) **Shrunken and broken kernels.** All matter that passes through a 0.064 x 3/8 oblonghole sieve after sieving according to procedures prescribed in the FGIS instructions.

Principles Governing the Application of Standards

Basis of determination.

Each determination of heat-damaged kernels, damaged kernels, foreign material, wheat of other classes, contrasting classes, and subclasses is made on the basis of the grain when free from dockage and shrunken and broken kernels. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain when free from dockage, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from dockage.

(b) **Grades and grade requirements for Mixed wheat.**

Mixed wheat is graded according to the U.S. numerical and U.S. sample grade requirements of the class of wheat that predominates in the mixture, except that the factor wheat of other classes is disregarded.

Special Grades and Special Grade Requirements

(a) **Ergoty wheat.** Wheat that contains more than 0.05 percent of ergot.

(b) **Garlicky wheat.** Wheat that contains in a 1,000-gram portion more than two green garlic bulblets or an equivalent quantity of dry or partly dry bulblets.

(c) **Infested wheat.** Wheat that is infested with 2 or more live insects injurious to stored grain.

(d) **Light smutty wheat.** Wheat that has an unmistakable odor of smut, or which contains, in a 250 gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 5 smut balls, but not in excess of a quantity equal to 30 smut balls of average size.

(e) **Smutty wheat.** Wheat that contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 30 smut balls of average size.

(f) **Treated wheat.** Wheat that has been scoured, limed, washed, sulfured, or treated in such a manner that the true quality is not reflected by either the numerical grades or the U.S. sample grade designation alone.

Wheat

Table No. 1 - Grades and Grade Requirements

	Grades U.S. Nos.[1]				
Grading Factors	1	2	3	4	5
Minimum pound limits of:					
Test Weight					
Hard Red Spring wheat or White Club wheat (lbs/bu)	58.0	57.0	55.0	53.0	50.0
All other classes and subclasses (lbs/bu)	60.0	58.0	56.0	54.0	51.0
Maximum percent limits of:					
Defects					
Damaged kernel					
Heat (part of total)	0.2	0.2	0.5	1.0	3.0
Total	2.0	4.0	7.0	10.0	15.0
Foreign material	0.4	0.7	1.3	3.0	5.0
Shrunken and broken kernels	3.0	5.0	8.0	12.0	20.0
Total[1]	3.0	5.0	8.0	12.0	20.0
Wheat of other classes[2]					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total[3]	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
Maximum count limits of:					
Other material					
Animal filth	1	1	1	1	1
Castor beans	1	1	1	1	1
Crotalaria seeds	2	2	2	2	2
Glass	0	0	0	0	0
Stone	3	3	3	3	3
Unknown foreign substance	3	3	3	3	3
Total[4]	4	4	4	4	4
Insect-damaged kernels in 100 grams	31	31	31	31	31

U.S. Sample Grade

Wheat that:

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

(b) Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

(c) Is heating or of distinctly low quality.

[1]Includes damaged kernels (total), foreign material, and shrunken and broken kernels.

[2]Unclassed wheat of any grade may contain not more than 10.0 percent of wheat of other classes.

[3]Includes contrasting classes.

[4]Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance.

Grade wheat as follows:

Step 1. Examine the sample for heating, odor, animal filth, castor beans, crotalaria seeds, garlic, glass, insect infestation, unknown foreign substances, and other unusual conditions.

Step 2. Divide out a representative portion from the sample and determine its moisture content.

Step 3. Determine the percentage of dockage in the sample.

Step 4. Examine the dockage-free sample for ergot, smut, stones, and treated seeds.

Step 5. Determine the test weight per bushel of the dockage-free sample.

Step 6. When deemed necessary, divide out a representative portion from the dockage-free sample and determine the percentage of protein.

Step 7. Divide out a representative portion from the dockage-free sample and determine the percentage of shrunken and broken kernels (SHBN).

Step 8. When deemed necessary, divide out representative portions from the SHBN-free sample and determine the percentage of class, contrasting classes, damaged kernels, heat-damaged kernels, foreign material, subclass, and wheat of other classes.

Portion Sizes

Portion sizes are as follows:

Damaged kernels	15 grams
Dockage	250 grams
Shrunken and broken	200 grams
Foreign material	30 grams
Heating	The lot as a whole.
Infestation	The original sample or lot as a whole.
Moisture	The amount recommended by the instrument manufacturer.
Objectionable odors	The original sample or lot as a whole.
Test weight per bushel	An amount sufficient to cause grain to overflow a kettle.

Procedure for Determining Dockage with Hand Sieves

Step 1. Nest the appropriate sieve(s) on top of a bottom pan. Place a 12/64-inch round-hole sieve on top of a 5/64-inch round-hole sieve.

Step 2. Pour the sample into the center of the top sieve, place the sieve(s) in a mechanical grain sizer, set the sizer's timer to 20, and turn it on. If a mechanical sizer is not available, hold the sieves and bottom pan level. Then, using a steady motion, move the sieve from right to left approximately 10 inches and then return from left to right. Repeat this operation 20 times.

Step 3. Remove the dockage. Consider dockage to be all coarse material that remains on top of the sieves and all material that passed through the bottom sieve.

Test Weight per Bushel

Test weight per bushel is the weight of the volume of grain that is required to fill a Winchester bushel (2,150.42 cubic inch) to capacity. Since test weight per bushel tends to increase as moisture content decreases, determine it as quickly as possible after the grain is sampled. Determine test weight per bushel after the removal of dockage.

Step 1. Pour the sample through a funnel into a kettle until the grain overflows the kettle.

Step 2. After pouring the grain into the kettle, level it off by making three, full-length, zigzag motions with a stroker.

Kernel 3: The germ cover is broken open with a sprout showing at the bottom.

Step 3. Then weigh the filled kettle on either (1) a special beam scale attached to the funnel stand, (2) an electronic scale programmed to convert gram weight to test weight per bushel, or (3) a standard laboratory scale.

Shrunken & Broken

Repeat hand sieving procedures listed above using a 0.064 inch x 3/8 inch oblong-hole sieve.

Blight, Scab Damage

Kernels and pieces of wheat which have a dull, lifeless, chalky appearance. To function as scab damage, the entire surface area must meet the minimum appearance criteria shown. Kernels meeting this criteria sometimes contain a pinkish mold.

Ergot

A purple-black fungal mass (sclerotium) that may occur in cultivated grasses (wheat, triticale, barley, oats, rye) when infected by the fungus *Claviceps purpurea*. The fungus invades the female portion of the host plant and replaces the ovary with a mass of fungal tissue. The ergots contain alkaloids produced by the fungus which can cause gangrene or convulsions. **Note**: the picture in this manual is not an official line slide.

Sprout damage

Kernels with the germ covers broken open due to germination and showing sprouts or from which the sprouts have broken off shall be damage. Illustrated from left to right:

Kernel 1: The sprout is broken off leaving part of the germ cover over the socket area.

Kernel 2: The sprout is broken off leaving no germ cover over the socket area.

Note: the starchy area may or may not be discolored.

Kernel 4: The germ cover is broken open with a sprout showing at the top.

Note: Sprouts must be equal to or greater than shown on kernels (3) and (4).

Heat Damage

Pieces of kernels of wheat damaged by heat and materially discolored to the extent shown. Whole kernels of wheat must occasionally be cross-sectioned (see Kernel 3) to confirm the entire face of both halves are as dark or darker than shown in Kernels 1 or 2.

Germ Damage (Sick-Damaged as result of Respiration)

Kernels with germs as dark or darker than the kernel shown shall be damage.

Procedure: Kernels should be scraped carefully with a sharp instrument such as picks, to avoid scraping too deeply and destroying the evidence of damage.

Note: Germs with more intense discoloration require less coverage to be considered damage.

Wheat Weevil or Insect Bored Damage

Kernels that have been bored or tunneled by insects shall be damage. Illustrated from left to right:

Kernel 1: Kernel that has been tunneled.

Kernels 2 & 3: Kernels that have been bored.

Wheat - Black Tip Damage (Fungus)

Kernels affected by black tip fungus to the extent that the discoloration (fungus growth) extends beyond the germ and continues around at least one cheek and into the crease. All conditions must be met to be considered damage.

Kernel 1: The minimum degree of discoloration and amount of coverage required on the germ.

Kernel 2: The minimum degree of discoloration required in the “continuous band” that extends around the cheek. The width of the band is irrelevant.

Kernel 3: The minimum degree of discoloration required to extend into the crease. The amount of discoloration (area of coverage) is immaterial

WORKSHEET

SAMPLE PREPARATION - WHEAT

DOCKAGE

WEIGHT (G) OF INITIAL PORTION TESTED _____ (1)

WEIGHT (G) OF MATERIAL REMOVED _____ (2)

PERCENT (#2/#1 X 100) _____

TEST WEIGHT

WEIGHT (LBS) PER BUSHEL _____

SHRUNKEN AND BROKEN KERNELS

WEIGHT (G) OF INITIAL PORTION TESTED _____ (1)

WEIGHT (G) OF MATERIAL REMOVED _____ (2)

PERCENT (#2/#1 x 100) _____

Pictures and descriptions of kernel damage were reproduced from the interpretive line slides with the permission of Seedburo Equipment Company.

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Text in this publication was compiled from United States Department of Agriculture publication *Official United States Standards for Grain* and *Inspecting Grain, Practical Procedures for Grain Handlers.*

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