Agronomy Guide

Purdue University Cooperative Extension Service

CROPS (WHEAT) AY-243

USDA Grading Standards and Moisture Conversion Table for Wheat

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Wheat is any grain of common wheat, club wheat, and durum wheat, which before the removal of dockage, consists of 50 percent or more of these wheats and not more than 10 percent of other grains for which standards have been established and which, after the removal of dockage, contains 50 percent or more of whole kernels of one or more of these wheats. Wheat is divided into the following seven classes: Hard Red Spring Wheat, Durum Wheat, Soft Red Winter Wheat, Hard Red Winter Wheat, White Wheat, Unclassed Wheat, and Mixed Wheat. However, Soft Red Winter Wheat is the only wheat class that will be discussed in this publication and information contained within this document will pertain only to Soft Red Winter Wheat. The class Soft Red Winter Wheat includes all varieties of Soft Red Winter Wheat. There are no subclasses in this class. 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. This may be obtained by calling GIPSA at 301-734-5524 or faxing requests to the attention of Ed Lawson at 301-734-8455. 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.

Basis of Determination

Each determination of dockage, moisture, temperature, odor, garlic, live weevils or other insects injurious to stored grain, and distinctly low quality is made on the grain as received from the sample taken from an incoming truck, rail car, etc. All other "tests" are conducted after dockage has been removed. Moisture is recorded to the nearest tenth of a percent (e.g. 17.34 is recorded as 17.3%).

Dockage - The word "dockage" means weed seed, weed stems, chaff, straw, grain other than wheat, sand, soil, and any other material other than wheat, that can be removed readily from the wheat by the use of appropriate sieves and cleaning devices. Underdeveloped, shriveled, and small pieces of wheat kernels removed when properly separating the material other than wheat is also a part of dockage along with those wheat kernels that cannot be recovered by properly rescreening or recleaning. Determination of dockage is made in the initial sieving. Shrunken and broken kernels and foreign material are determined after the dockage has been removed. The percent dockage is rounded and reported to the nearest tenth percent. Dockage is determined from a 1,000 gram sample.

Soft Red Winter Wheat Grading Factors

Foreign Material - Foreign material refers to all matter other than wheat, including stones, that is not separated from the wheat in the proper removal of dockage. It is recorded to the nearest tenth of a percent.

Damaged Kernels (Total) - This factor includes all types of damage found in wheat. It is all inclusive in that kernels and pieces of kernels of wheat plus other grains are included. Damaged Kernels (Total) means heat-damaged, sprouted, frosted, badly

ground-damaged, badly weather-damaged, moldy, diseased, or otherwise materially damaged. Note that the percentage of heat damage is added to become a part of the Damaged Kernels (Total). Damaged Kernels (Total) are recorded to the nearest tenth of a percent. Use the "Wheat Kernel Damage" reference publication to help you with these determinations.

Heat-damaged Kernels - Refers to kernels and pieces of kernels of wheat and other grains that have been "severely" discolored or damaged by heat. This damage may result from external heating, such as improper drying, or from heating as a result of excess moisture and spoilage. Heat-damaged kernels are reported to the nearest tenth of a percent. Use the "Wheat Kernel Damage" reference publication to help you with this determination.

Other Grains - Other grains as used in this discussion are rye, oats, corn, grain sorghum, barley, flax, emmer, spelt, einkorn, polish wheat, poulard wheat, cultivated buckwheat, and soybeans. These grains are also considered foreign material, even when damaged.

Insect Damaged Wheat Kernels - Wheat is determined to be U.S. Sample Grade when 32 or more insect damaged kernels per 100 grams are found. The process used for this determination is somewhat complex and may require up to 3 stages. This process is best diagrammed and explained in the Grain Inspection Handbook reference. Do not confuse insect chewed with insect damage (i.e. damage is a pin hole, tunneling vs. chewed where the tip of the kernel or germ is missing). Insect chewed is not considered as damage. When applicable, "Sample Grade Due to Insect Damaged Kernels" is included in the "Remarks" section of the certificate

Contrasting Classes - A contrasting class in soft red winter wheat is any durum wheat. Soft red winter wheat flour is especially suited for cake mixes while flour from durum wheat is required for spaghetti production. Thus, there is a "contrast" in use. Each wheat has its own contrasting classes. "Contrasting Classes" followed by the percent rounded to the nearest tenth is recorded in "Remarks" area of the certificate.

Wheat of Other Classes (Total) - This factor spotlights the presence of other wheats in a sample. Some mixtures may be of minor importance. For example, if a soft red winter wheat contained 8% hard red winter wheat, the flour from such a mixture might be acceptable, but not the most desirable for cake mixes when compared to flour from 100% soft red winter wheat. Wheat of Other Classes (Total) also includes percent of Contrasting Classes. When this occurs, "Wheat of other classes" (Total to nearest tenth of a percent) is stated in the "Remarks" section of the certificate.

Distinctly Low Quality - The Grain Inspection, Packers, and Stockyard Administration (GIPSA) reserves the use of this term to describe wheat 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 wheat is of Distinctly Low Quality. When a sampler is collecting wheat 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, wheat is described as containing "plywood scraps". From information above, the wheat would be designated: Distinctly Low Quality (Plywood scraps). This grading factor should not be confused with the other conditions which can also cause wheat 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.

Shrunken and Broken Kernels - These are kernels and pieces of kernels of wheat and other matter that will pass readily through a .064 x 3/8 inch oblong hole sieve after the dockage has been removed. It is recorded to the nearest tenth of a percent.

Stones and Glass - If four or more stones are present in a sample of 1-1/4 quarts (1,000 gm.) or the total weight of the stones exceeds 0.1 percent of the sample weight, the sample must be graded "U.S. Sample Grade". Cinders are considered Stones. Wheat will be graded "U.S. Sample Grade" when one or more pieces of glass are found per 1000 grams. "Stones" or "Glass" respectively, is recorded when applicable in the "Remarks" section of the certificate.

Cumulative Total - If a cumulative total of 4 or more sample grade factors (e.g. 3 stones + 1 animal filth + 1 unknown = 4 or more sample grade factors) are found, the sample is graded "U.S. Sample Grade." The "cumulative total of 4 or more sample grade factors" is recorded in the "Remarks" section.

Defects (Total) - This factor is determined by adding the percentages of Damaged Kernels (Total), Foreign Material, and Shrunken and Broken Kernels.

Test Weight - Good quality wheat of low moisture content can be expected to have a good test weight. The weight per bushel is expressed to the nearest

tenth of a pound. For example, 60.18 is reported as 60.2 lbs.

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

Smutty - There are two special grades of smutty wheat — Light Smutty and Smutty.

Light Smutty - Applies to wheat with a smutty odor, or when wheat contains more than 5 smut balls in 250 grams of grain; the term “Light Smutty” is added to and made part of the grade designation.

Smutty - Applies to wheat that contains 31 or more smut balls per 250 gram sample; the word “Smutty” is added to and made part of the grade designation.

Garlicky - Wheat that contains three or more green garlic bulblets or an equivalent of dry bulblets in a 1000-gram sample is considered Garlicky and the word “Garlicky” is added to and made part of the grade designation. Three dry or partly dry bulblets equal 1 green garlic bulblet. Garlic odor is not a basis for “Garlicky.”

Infested - Wheat that is infested with two or more live weevils, one live weevil and one or more other insects injurious to stored grain, or two or more other insects injurious to stored grain in a 1-1/4 quart (1,000 gm.) sample is considered infested. Wheat that is infested is graded and designated according to the grade requirements of the standards applicable to such wheat if it were not infested. The word “Infested” is added to and made part of the grade designation.

Ergoty - Wheat that contains more than 0.05 percent per 1000 grams ergot is considered Ergoty. Ergoty wheat is graded and designated according to the grade requirements of the standards applicable if it were not “Ergoty”. The word “Ergoty” is added to and made part of the grade designation. Note that ergot also fits the definition of foreign material in wheat and must be included as such.

Treated Wheat - Wheat that has been scoured, limed, washed, sulphured or treated with a substance such that the grade designation alone does not truly describe its quality. Wheat that is “Treated” will have the words “Treated (treatment(s))” as part of the grade designation (e.g. U.S. No. 1 Soft Red Winter Wheat, Treated (limed), Dockage 0.4%).

These six special grades and dockage are treated similarly to the special grades in corn and soybeans in that they do not affect the numerical grade, but they are written as a part of the grade designation following the class.

References:

- Wheat Kernel Damage #213Contact: 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 Wheat

Grade	Minimum limits: Test Weight Per Bushel — Hard Red Spring wheat or White Club wheat	Minimum limits: Test Weight Per Bushel — All other classes and subclasses	Maximum limits of — Heat-damaged Kernels	Damaged Kernels (Total)[2]/	Foreign Material	Shrunken and Broken Kernels	Defects (Total)[3]/	Wheat of Other Classes[4]/ Contrasting Classes	Wheat of Other Classes[4]/ (Total)[5]/
	lbs	lbs	%	%	%	%	%	%	%
U.S. No. 1	58.0	60.0	0.2	2.0	0.4	3.0	3.0	1.0	3.0
U.S. No. 2	57.0	58.0	0.2	4.0	0.7	5.0	5.0	2.0	5.0
U.S. No. 3	55.0	56.0	0.5	7.0	1.3	8.0	8.0	3.0	10.0
U.S. No. 4	53.0	54.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
U.S. No. 5	50.0	51.0	3.0	15.0	5.0	20.0	20.0	10.0	10.0

U.S. Sample Grade:

U.S. Sample Grade shall be wheat which:

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

2) Contains 32 or more insect-damaged kernels per 100 grams of wheat, or

3) Contains 4 or more stones, 1 or more pieces of glass, 3 or more crotalaria seeds (Crotalaria ssp.), 2 or more castor beans (Ricinus communis), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), or 2 or more rodent pellets, bird droppings, an equivalent quantity of other animal filth per 1,000 grams of wheat, or a cumulative total of 4 or more of these items; or

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

5) Is heating or otherwise of distinctly low quality.

1/ These requirements also apply when Hard Red Spring or White Club wheat predominate in a sample of Mixed wheat.

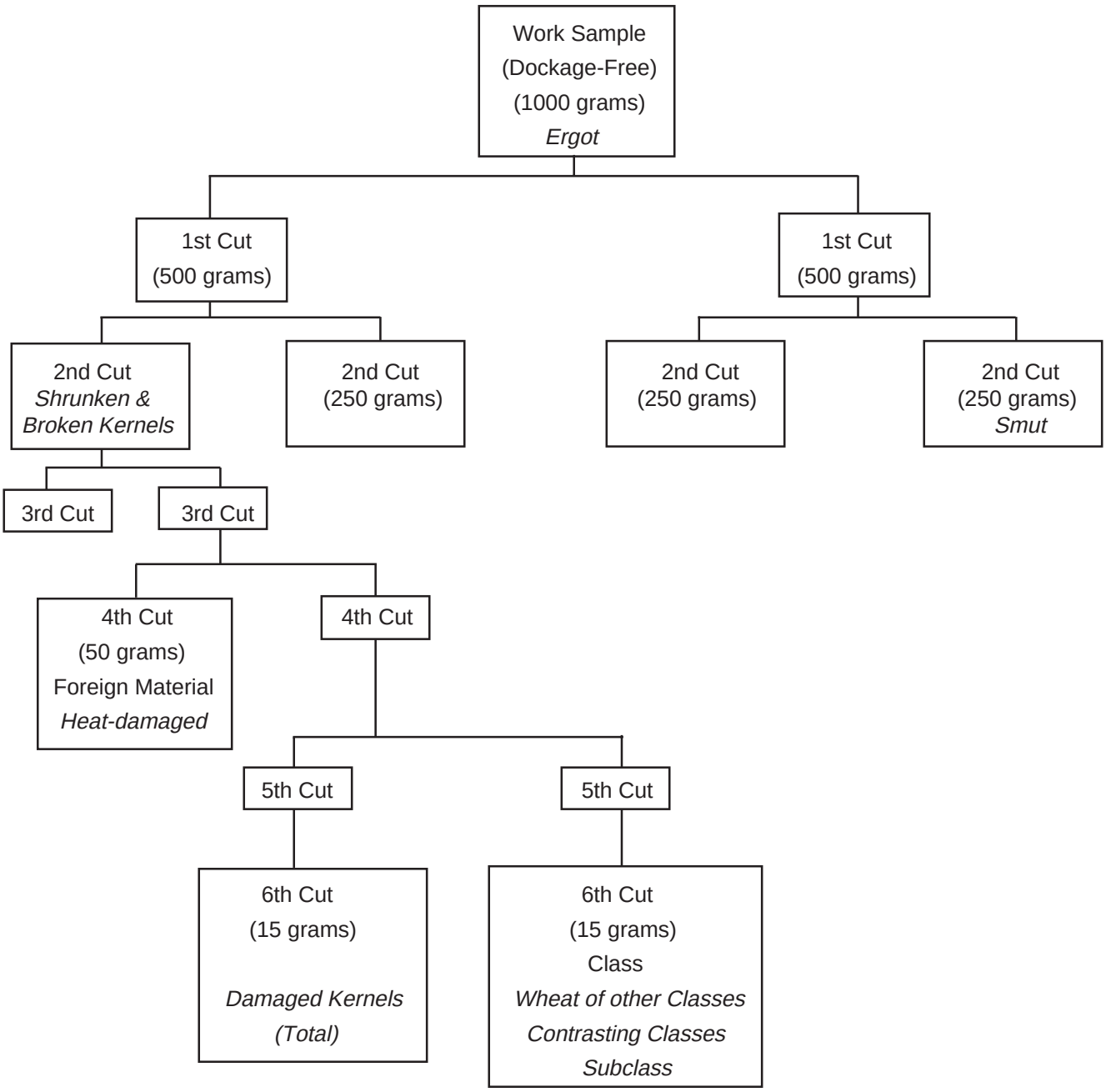
2/ Includes Heat-damaged Kernels.

3/ Defects (Total) include Damaged Kernels (Total), Foreign Material, and Shrunken and Broken Kernels. The sum of these three factors may not exceed the limit for defects.

4/ Unclassed wheat of any grade may contain not more than 10 percent of wheat of other classes.

5/ Includes Contrasting Classes.

Flow Chart Illustrating the Progression of Wheat Separations



Wheat Moisture Conversion Table

The following table shows the number of pounds of soft red winter wheat at various percent moisture levels required to make 1 bushel. (One standard bushel of soft red winter wheat = 60 pounds at 13.5% moisture, the maximum permitted for the U.S. No. 1 wheat.)

The table gives pounds per bushel for moisture contents ranging from 8 to 25%. For weights at moisture levels below 8% and above 25%, use the following equation:

$$\text{Lb./bu.} = \frac{51.90}{(100 - \%\ \text{water})} \times 100$$

The figure 51.90 represents pounds of dry matter in a standard bushel of soft red winter wheat.

Pct. moisture	Lb./bu.	Pct. moisture	Lb./bu.	Pct. moisture	Lb./bu.	Pct. moisture	Lb./bu.	Pct. moisture	Lb./bu.
8.0	56.41	12.0	58.98	16.0	61.78	20.0	64.88	24.0	68.29
.1	56.41	.1	59.04	.1	61.86	.1	64.96	.1	68.38
.2	56.54	.2	59.11	.2	61.93	.2	65.04	.2	68.47
.3	56.60	.3	59.18	.3	62.01	.3	65.12	.3	68.56
.4	56.66	.4	59.24	.4	62.08	.4	65.20	.4	68.65
.5	56.72	.5	59.31	.5	62.15	.5	65.28	.5	68.74
.6	56.78	.6	59.38	.6	62.23	.6	65.36	.6	68.83
.7	56.85	.7	59.45	.7	62.30	.7	65.44	.7	68.92
.8	56.90	.8	59.52	.8	62.38	.8	65.53	.8	69.02
.9	56.97	.9	59.59	.9	62.45	.9	65.61	.9	69.11
9.0	57.03	13.0	59.66	17.0	62.53	21.0	65.70	25.0	69.20
.1	57.09	.1	59.72	.1	62.61	.1	65.78		
.2	57.16	.2	59.79	.2	62.68	.2	65.86		
.3	57.22	.3	59.86	.3	62.75	.3	65.95		
.4	57.28	.4	59.93	.4	62.83	.4	66.03		
.5	57.35	.5	60.00	.5	62.91	.5	66.11		
.6	57.41	.6	60.07	.6	62.98	.6	66.20		
.7	57.47	.7	60.13	.7	63.06	.7	66.28		
.8	57.54	.8	60.21	.8	63.14	.8	66.37		
.9	57.60	.9	60.28	.9	63.22	.9	66.45		
10.0	57.67	14.0	60.35	18.0	63.29	22.0	66.54		
.1	57.73	.1	60.42	.1	63.37	.1	66.62		
.2	57.79	.2	60.49	.2	63.45	.2	66.71		
.3	57.86	.3	60.56	.3	63.53	.3	66.80		
.4	57.92	.4	60.63	.4	63.60	.4	66.88		
.5	57.99	.5	60.70	.5	63.68	.5	66.97		
.6	58.05	.6	60.77	.6	63.76	.6	67.05		
.7	58.12	.7	60.84	.7	63.84	.7	67.14		
.8	58.18	.8	60.92	.8	63.92	.8	67.23		
.9	58.25	.9	60.99	.9	63.99	.9	67.31		
11.0	58.31	15.0	61.06	19.0	64.07	23.0	67.40		
.1	58.38	.1	61.13	.1	64.15	.1	67.49		
.2	58.45	.2	61.20	.2	64.23	.2	67.58		
.3	58.51	.3	61.27	.3	64.31	.3	67.66		
.4	58.58	.4	61.35	.4	64.39	.4	67.75		
.5	58.64	.5	61.42	.5	64.47	.5	67.84		
.6	58.71	.6	61.49	.6	64.55	.6	67.93		
.7	58.78	.7	61.56	.7	64.63	.7	68.02		
.8	58.84	.8	61.64	.8	64.71	.8	68.11		
.9	58.91	.9	61.71	.9	64.79	.9	68.20		

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