Agronomy Guide

Purdue University Cooperative Extension Service

CROPS (SOYBEANS) AY-224

USDA Grading Standards and Moisture Conversion Table for Soybeans

M.G. Evans, E.P. Christmas, and C.B. Southard
Agronomy Department, Purdue University

Soybean Grading

Soybeans are any grain that consists of 50 percent or more of whole or broken soybeans which will not pass readily through an 8/64 sieve and not 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. 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.

Class, splits, and damaged kernels are determined after foreign material is removed. Soybeans are divided into the following two classes:

Yellow Soybeans - Soybeans that have a yellow seed coat and are yellow in cross-section. Up to 10 percent of other colors are allowed in yellow soybeans.

Mixed Soybeans - Any mixture of soybeans that does not meet the requirements of yellow soybeans. See Soybeans of Other Colors. For Mixed Soybeans, the percentage of yellow soybeans and soybeans of other colors is recorded to the nearest tenth in the “Remarks” section of the certificate.

Moisture - The moisture content of soybean seed is extremely important but it is no longer used as a grading factor. Loss of quality of stored seed hinges largely on the amount of moisture present in the sample. Moisture is an important factor in most discount schedules. Moisture is recorded to the nearest tenth of a percent.

Grading Factors in Soybeans

Test Weight - Good quality seed of low moisture content can be expected to have a good test weight. Test weight is recorded and rounded to the nearest tenth of a percent.

Splits - Any soybean having more than 1/4 of the seed missing is considered a split. This factor includes only sound splits - those free from damage. See Damaged Kernels (Total) below. Splits are determined from a sub-sample of approximately 125 grams after the removal of all foreign material. Splits are recorded to the nearest tenth of a percent. (e.g. 16.26% is recorded as 16.3%).

Damaged Kernels (Total) - This factor includes all types of damage found in whole and pieces of soybeans. Damaged Kernels (Total) includes the following: heat damage, sprout damage, frost damage, immature seed, ground-damage, mold damage, insect damage, and seeds that have become slightly discolored by heat, etc. Note that the percentage of heat damage is added to the percentage of other types of damage to obtain the percent-

age of Damaged Kernels (Total). Stink bug stung kernels are considered damaged kernels at the rate of 1/4 of actual total percentage of stung kernels (e.g. 12 grams is considered as 3 grams of damage). Use the publication "Soybean Kernel Damage" (#215 O.S.U.) to help you make these determinations. Damaged Kernels (Total) are reported to the nearest tenth of a percent.

Heat-damaged Kernels - Soybeans that are severely discolored (black or dark brown) either from external heating, such as improper drying, or from heating as a result of excess moisture and spoiling. Almost all heat damage is the result of storing grain too wet. Use the reference publication "Soybean Kernel Damage" to help you make this determination. Heat-damaged Kernels are reported to the nearest tenth of a percent.

Coarse Foreign Material - This includes kernels of corn, cockleburs, sticks, stalks, etc that do not pass through an 8/64 inch sieve. This test is made on 1000 grams. This percentage must be added to Fine Foreign Material. The sum of the two foreign materials is recorded to the nearest tenth of a percent.

Fine Foreign Material - This includes anything such as rodent excreta and stones that pass through an 8/64 inch sieve including soybeans and pieces of soybeans plus all matter other than soybeans that remain on the sieve after sieving. This test is made on 125 grams. This percentage must be added to Coarse Foreign Material. The sum of the two foreign materials is recorded to the nearest tenth of a percent.

Soybeans of Other Colors - These colors serve as a grading factor in yellow soybeans. When soybeans of other colors (black, brown, and bicolored) occur in quantities of 10 percent or less, the percentage is a factor in determining the grade of yellow soybeans. When other colors exceed 10 percent, the sample is then classified as Mixed Soybeans. Percentages of other colors are not listed as part of the grade designation for Mixed Soybeans but are included in the "Remarks" section as previously indicated.

Stones - If four or more stones are present in a sample of 1-1/4 quarts (1000 gm.) and the total weight of stones exceeds 0.1 percent of the sample weight, the sample must be graded "U.S. Sample Grade." Cinders are considered Stones.

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

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.

Cumulative Total - If a cumulative total of 11 or more sample grade factors (e.g. 3 stones + 2 animal filth + 6 unknown = 11 or more sample grade factors) are found, the sample is graded "U.S. Sample Grade." These factors include any combination of animal filth, castor beans, crotalaria seeds, glass, stones, and any unknown foreign substance. When applicable, "cumulative total of 11 or more sample grade factors" is recorded in the "Remarks" section.

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

Purple Mottled or Stained - Soybean samples which in general appearance are 2% or more purple mottled or purple stained or in general appearance are 2% or more discolored by dirt or dirt-like substances are considered to be "Purple Mottled or Stained." This determination is made on 125 grams. A soybean kernel must have 50% or more of its surface discolored to be considered. When applicable "Purple Mottled or Stained" is added to and made part of the grade designation on the certificate.

Garlicky - Soybeans that contain five or more green garlic bulblets in 1000 grams are considered garlicky. Garlicky soybeans are graded and designated according to the grade requirements of the standards applicable to such soybeans if they were not garlicky and the word "Garlicky" is added to and made part of the grade designation. Three dry bulblets are equal to one green bulblet. A garlic odor is not a basis for "Garlicky."

Infested - Soybeans which contain two or more live weevils, one live weevil and five or more other live insects injurious to stored grain, or 10 or more other live insects injurious to stored grain in the sample are considered “Infested.” Infested soybeans are graded and designated according to the grade requirements of the standards applicable to such soybeans if they were not infested. The word “Infested” is added to and made part of the grade designation.

The special grades “Garlicky”, “Infested” and “Purple Mottled and Stained” do not affect the numerical grade. They are treated similarly to the special grades which are applicable to corn.

References:

- Soybean Kernel Damage #215

  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 Soybeans

Grade	Minimum Test Weight Per Bushel	Splits	Maximum limits of — Damaged Kernels (Total)	Heat-damaged Kernels	Foreign Material	Soybeans of Other Colors
	lbs.	%	%	%	%	%
U.S. No. 1	56.0	10.0	2.0	0.2	1.0	1.0
U.S. No. 2	54.0	20.0	3.0	0.5	2.0	2.0
U.S. No. 3	52.0	30.0	5.0	1.0	3.0	5.0
U.S. No. 4	49.0	40.0	8.0	3.0	5.0	10.0

U.S. Sample Grade:

U.S. Sample Grade shall be soybeans which:

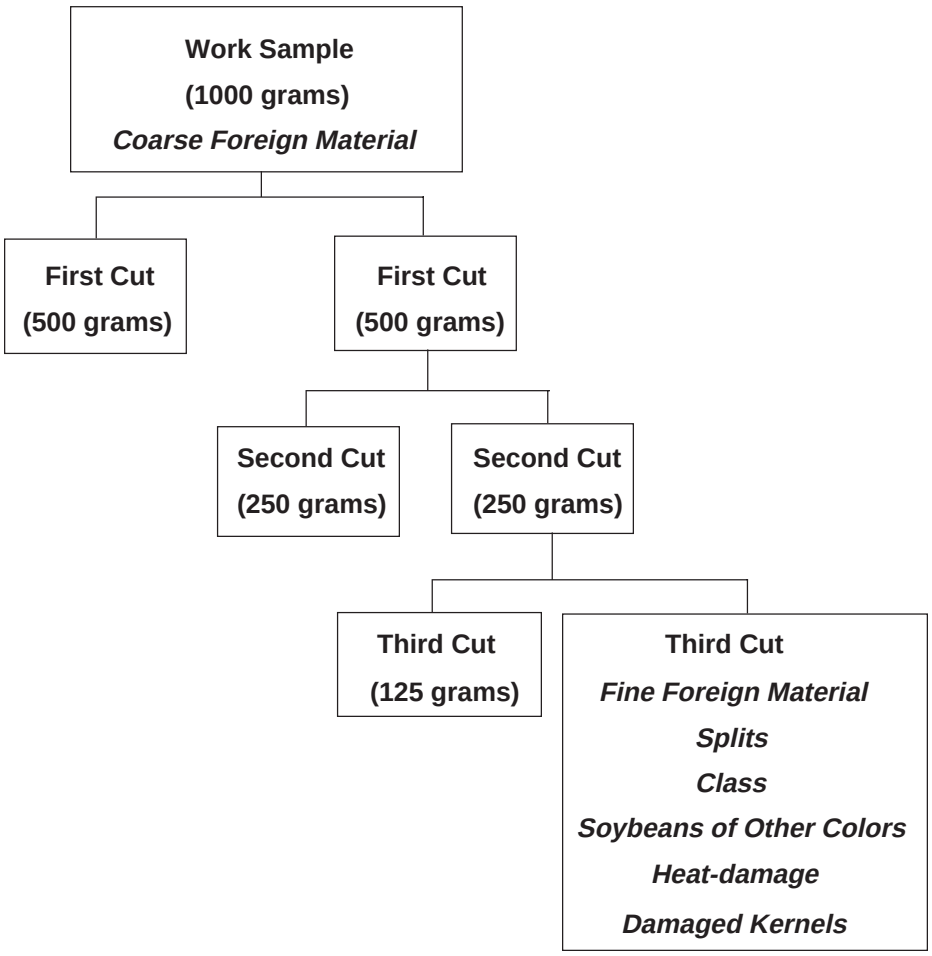
a) Do not meet the requirements for U.S. No. 1, 2, 3, 4; or

b) Contain 4 or more stones which have an aggregate weight in excess of 0.1 percent of the sample weight, 1 or more pieces of glass, 3 or more crotalaria seeds (Crotalaria ssp.), 2 or more castor beans (Ricinus communis), 4 or more pieces of an unknown foreign substance(s) or a commonly recognized harmful or toxic substances, 10 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth in 1,000 grams of soybeans; or a cumulative total of 11 or more of any combination of these sample grade factors; or

c) Have a musty, sour, or commercially objectionable foreign odor (except garlic odor); or

d) Are heating or otherwise of distinctly low quality.

Flow Chart Illustrating the Progression of Soybean Separations



Soybean Moisture Conversion Table

The following table shows the number of pounds of soybeans at varoius moisture levels required to make 1 bushel. (One standard bushel = 60 pounds at 13% moisture.)

The table below gives pounds per bushel for moisture contents ranging from 7 to 20%. For weights at moisture levels below 7% and above 20%, use the following equation:

$$\text{Lb./bu.} = \frac{52.2}{(100 - \%\ \text{water})} \times 100$$

The figure 52.2 represents pounds of dry matter (soybeans) in a standard bushel.

Pct. moisture	Lb./bu.	Pct. moisture	Pct. Lb./bu.	Pct. moisture	Lb./bu.	moisture	Lb./bu.
7.0	56.13	11.0	58.65	15.0	61.41	19.0	64.44
.1	56.19	.1	58.72	.1	61.48	.1	64.52
.2	56.25	.2	58.78	.2	61.56	.2	64.60
.3	56.31	.3	58.85	.3	61.63	.3	64.68
.4	56.37	.4	58.92	.4	61.70	.4	64.76
.5	56.43	.5	58.98	.5	61.77	.5	64.84
.6	56.49	.6	59.05	.6	61.85	.6	64.92
.7	56.55	.7	59.12	.7	61.92	.7	65.00
.8	56.61	.8	59.18	.8	61.99	.8	65.09
.9	56.67	.9	59.25	.9	62.07	.9	65.17
8.0	56.74	12.0	59.32	16.0	62.14	20.0	65.25
.1	56.80	.1	59.39	.1	62.22		
.2	56.86	.2	59.45	.2	62.29		
.3	56.92	.3	59.52	.3	62.37		
.4	56.99	.4	59.59	.4	62.44		
.5	57.05	.5	59.66	.5	62.51		
.6	57.11	.6	59.73	.6	62.59		
.7	57.17	.7	59.79	.7	62.66		
.8	57.24	.8	59.87	.8	62.74		
.9	57.30	.9	59.93	.9	62.81		
9.0	57.36	13.0	60.00	17.0	62.89		
.1	57.43	.1	60.07	.1	62.97		
.2	57.49	.2	60.14	.2	63.04		
.3	57.55	.3	60.21	.3	63.12		
.4	57.62	.4	60.28	.4	63.20		
.5	57.68	.5	60.35	.5	63.27		
.6	57.74	.6	60.42	.6	63.35		
.7	57.81	.7	60.49	.7	63.43		
.8	57.87	.8	60.56	.8	63.50		
.9	57.93	.9	60.63	.9	63.58		
10.0	58.00	14.0	60.70	18.0	63.66		
.1	58.06	.1	60.77	.1	63.74		
.2	58.13	.2	60.84	.2	63.81		
.3	58.19	.3	60.91	.3	63.89		
.4	58.26	.4	60.98	.4	63.97		
.5	58.32	.5	61.05	.5	64.05		
.6	58.39	.6	61.12	.6	64.13		
.7	58.45	.7	61.19	.7	64.21		
.8	58.52	.8	61.26	.8	64.29		
.9	58.59	.9	61.34	.9	64.36		

REV 10/97

Cooperative Extension work in Agriculture and Home Economics, state of Indiana, Purdue University, and U.S. Department of Agriculture cooperating; H. A. Wadsworth, Director, West Lafayette, IN. Issued in furtherance of the acts of May 8 and June 30, 1914. The Cooperative Extension Service of Purdue University is an affirmative action/equal opportunity institution.