

GRAIN INSPECTION HANDBOOK

BOOK II, CHAPTER 10

SOYBEANS

CHAPTER 10

SOYBEANS

Section Number	Section	Page Number
10.1	GENERAL INFORMATION	10-1
10.2	GRADES AND GRADE REQUIREMENTS	10-1
10.3	GRADE DESIGNATIONS	10-2
10.4	SPECIAL GRADES	10-3
10.5	OPTIONAL GRADE DESIGNATION	10-3
10.6	BASIS OF DETERMINATION	10-4
10.7	DEFINITION OF SOYBEANS	10-5
10.8	HEATING	10-5
10.9	ODOR	10-6
10.10	MOISTURE	10-7
10.11	TEST WEIGHT	10-8
10.12	INFESTED SOYBEANS	10-8
10.13	GARLICKY SOYBEANS	10-9
10.14	PURPLE MOTTLED OR STAINED	10-10
10.15	DISTINCTLY LOW QUALITY	10-11
10.16	U.S. SAMPLE GRADE CRITERIA	10-12
10.17	FOREIGN MATERIAL	10-13
10.18	PROCESSING THE WORK SAMPLE	10-16
10.19	CLASS	10-18
10.20	SPLITS	10-19
10.21	DAMAGED KERNELS	10-20
10.22	HEAT-DAMAGED KERNELS	10-23
10.23	OFFICIAL CRITERIA	10-23

Tables/Charts

Table No. 1	Grades and Grade Requirements – Soybeans	10-2
Table No. 2	Basis of Determination	10-4
Table No. 3	Odor Classification Examples	10-6
Table No. 4	Insect Infestation	10-9
Table No. 5	U.S. Sample Grade Criteria	10-13
Table No. 6	Approximate Analytical Portion Sizes	10-18
		10-15
Chart 1	Procedure for Determining Foreign Material	
Chart 2	Dividing the Work Sample	10-17

10.1 GENERAL INFORMATION

- a. All quantities referenced in this chapter are approximate unless otherwise specified.
- b. Use an approved divider to obtain subportions of a sample for analysis unless otherwise specified.
- c. If an approved mechanical shaker is unavailable, inspectors may handsieve the sample. When handsieving, hold the sieve level in both hands with elbows close to the sides. In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left. Repeat this motion five times.
- d. For specific Visual Reference Images see SB-1.0 – SB-13.0.
- e. Official inspection personnel shall document inspection information during sampling and grading. See book IV, chapter 2.

The inspection process provides various factor information used to determine grade and to provide further information on the condition or quality of the soybeans. Each section of this chapter provides details on recording factor information. If requested by the applicant for inspection, additional information may be provided (e.g., an exact count on stones in addition to the percentage by weight, a percentage for a specific type of damage, etc.).

10.2 GRADES AND GRADE REQUIREMENTS

Soybeans are divided into two classes based on color: Yellow soybeans and Mixed soybeans. There are no subclasses. Each class is divided into four numerical grades and U.S. Sample Grade. Special grades are provided to emphasize special qualities or conditions affecting the value and are added to and made a part of the grade designation. They do not affect the numerical or sample grade designation.

**TABLE NO. 1 - GRADES AND GRADE REQUIREMENTS -
SOYBEANS**

Grade	Minimum Limits of -	Maximum Limits of -				
	Test weight per bushel (pounds)	Damaged Kernels		Foreign Material (percent)	Splits (percent)	Soybeans of other colors <u>1/</u> (percent)
		Heat (part of total) (percent)	Total (percent)			
U.S. No. 1	56.0	0.2	2.0	1.0	10.0	1.0
U.S. No. 2	54.0	0.5	3.0	2.0	20.0	2.0
U.S. No. 3	52.0	1.0	5.0	3.0	30.0	5.0
U.S. No. 4	49.0	3.0	8.0	5.0	40.0	10.0

U.S. Sample Grade:
 U.S. Sample Grade is soybeans that:

- Does not meet the requirements for grades U.S. No.1, 2, 3, or 4; or
- Contains 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* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 10 or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth in 1,000 grams of soybeans, or
- Contain 11 or more animal filth, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance(s) in any combination, or
- Have a musty, sour, or commercially objectionable foreign odor (except garlic odor); or
- Are heating or otherwise of distinctly low quality.

1/ Disregard for Mixed Soybeans

10.3 GRADE DESIGNATIONS

After completing the analysis, compare the results with the limits for each grade factor specified in table 1. Use the following guidelines when assigning grades.

- The letters "U.S.";
- The abbreviation "No." and the number of the grade or the words "Sample Grade";
- The words "or better," when applicable, shall be shown next;
- The name of the class; and
- The applicable special grades in alphabetical order.

For Mixed soybeans, record the percentage of Yellow soybeans and soybeans of other colors to the nearest tenth percent on the work record and in the "Remarks" section of the certificate.

For Mixed soybeans, record the percentage of Yellow soybeans and soybeans of other colors to the nearest tenth percent on the work record and in the "Remarks" section of the certificate.

Example: U.S. No. 2 Yellow Soybeans

U.S. No. 3 Mixed Soybeans
In "Remarks": Yellow Soybeans 75.4%
Soybeans of other colors 24.6%

U.S. No. 2 or better Yellow Soybeans

10.4 SPECIAL GRADES

Special grades identify unusual conditions in grain and are part of the grade designation. The soybean standards include three special grades:

- a. Garlicky Soybeans. Soybeans that contain five or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in a 1,000-gram portion.

Example: U.S. No. 3 Yellow Soybeans, Garlicky

- b. Infested Soybeans. Soybeans that are infested with live weevils or other insects injurious to stored grain.

Example: U.S. No. 2 Yellow Soybeans, Infested

- c. Purple Mottled or Stained Soybeans. Soybeans that are discolored with pink or purple seed coats, dirt or a dirt-like substance, or pokeberry stains, as determined on a portion of 400 grams with the use of an FGIS Interpretive Line Print.

Example: U.S. No. 2 Yellow Soybeans, Purple Mottled or Stained.

10.5 OPTIONAL GRADE DESIGNATION

The Official U.S. Standards for Grain provide for an optional grade designation, commonly referred to as "or better." Upon the request of an applicant, soybeans may be certified as U.S. No. 2 or better, U.S. No. 3 or better, etc. An "or better" grade designation cannot be applied to a U.S. No. 1 grade designation.

Example: U.S. No. 3 or better Yellow Soybeans

10.6 BASIS OF DETERMINATION

Distinctly Low Quality. The determination of distinctly low quality is made on the basis of the lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations. Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburs, crotalaria seeds, dockage, garlic, live insect infestation, large stones, moisture, temperature, and unknown foreign substance(s), and a commonly recognized harmful or toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling according to procedures prescribed in FGIS instructions.

All Other Determinations. Each determination of class, heat-damaged kernels, damaged kernels, splits, and soybeans of other colors is made on the basis of the grain when free from foreign material. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain as a whole.

TABLE NO. 2

BASIS OF DETERMINATION		
Lot as a Whole	Factors Determined Before the Removal of Foreign Material	Factors Determined After the Removal of Foreign Material
Distinctly low quality Heating Infested Odor	Distinctly low quality Garlicky Heating Infested Kind of Grain Moisture Odor Purple Mottled or Stained Stones Test Weight U.S. Sample Grade factors	Heat-damaged kernels Damaged kernels Odor Soybeans of other colors Splits

The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of soybeans.

10.7 DEFINITION OF SOYBEANS

Soybeans are defined as:

Grain that consists of 50 percent or more of whole or broken soybeans (Glycine max (L.) merr.) that will not pass through an 8/64 round-hole sieve and not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.

Whole soybeans are soybeans with three-fourths or more of the soybean present. Other grains for which standards have been established are barley, canola, corn, flaxseed, oats, rye, sorghum, sunflower seed, triticale, and wheat.

Basis of Determination. Normally, a visual appraisal of the sample is sufficient to determine if it meets the definition of soybeans. However, if an analysis is necessary, make the determination on a portion of 125 grams before the removal of foreign material.

If the sample does not meet the definition of soybeans, examine it further to determine if it is:

- a. Another grain for which standards have been established or
- b. Not standardized grain. No further analysis is necessary on a sample designated as not standardized grain unless a specific factor test is requested.

10.8 HEATING

Soybeans developing a high temperature from excessive respiration are considered heating. Heating soybeans, in its final stages, will usually have a sour or musty odor. Care should be taken not to confuse soybeans that are heating with soybeans that are warm and moist because of storage in bins, railcars, or other containers during hot weather.

Basis of Determination. Determine heating on evidence obtained at the time of sampling or on the basis of the sample as a whole.

Certification. Grade heating soybeans U.S. Sample Grade and record the word "Heating" in the "Remarks" section of the certificate.

10.9 ODOR

Basis of Determination. Determine odor on evidence obtained at the time of sampling or on the sample either before or after the removal of foreign material.

TABLE NO. 3

ODOR CLASSIFICATION EXAMPLES		
Sour	Musty	Commercially Objectionable Foreign Odors
Boot Fermenting Insect (acid) Pigpen Smoke ^{1/}	Ground Insect Moldy	Animal hides Decaying animal and vegetable matter Fertilizer Fumigant Insecticide Oil products Skunk Smoke Strong weed
^{1/} Smoke odors are considered sour only in canola, flaxseed, soybeans, and sunflower seed.		

Odors from Heat-Damaged Soybeans. When heat-damaged kernels are present, soybeans give off an odor very similar to smoke. Soybeans containing a “smoke” odor are considered as having a “sour” odor unless evidence of a fire-burnt material is present in the lot or the original sample. If evidence of a fire-burnt material is present in the lot or the sample, the smoke odor is considered a commercially objectionable foreign odor.

Commercially Objectionable Foreign Odors. Commercially objectionable foreign odors are odors, except smut and garlic odors, foreign to grain that render it unfit for normal commercial usage.

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of soybeans contains a fumigant or insecticide odor that prevents the determination of whether any other odor(s) exists, apply the following guidelines:

- a. Original Inspections. Allow the work portion to aerate in an open container for 4 hours, or less, if the odor dissipates in less time.
- b. Reinspections, Appeal and Board Appeal Inspections. Allow unworked file samples and new samples to aerate in an open container for 4 hours, or less, if the odor dissipates in less time. The 4-hour aeration requirement does not apply when the original work portion was aerated and retained as the final file.

Consider the sample as having a commercially objectionable foreign odor if the fumigant or insecticide odor persists based on the above criteria.

Final Determinations. The inspector(s) is responsible for making the final determination for all odors. A consensus of experienced inspectors is used, whenever possible, on samples containing marginal odors. The consensus approach is not required if no odor or a distinct odor is detected.

Certification. Grade soybeans containing a "distinct" musty, sour, or commercially objectionable foreign odor as U.S. Sample Grade. Record the words "Musty," "Sour," or "Commercially Objectionable Foreign Odor" in the "Remarks" section of the certificate.

10.10 MOISTURE

Water content in grain as determined by an approved device according to procedures prescribed in FGIS instructions.

Basis of Determination. Determine moisture before the removal of foreign material on a portion of approximately 350 grams.

The procedures for performing a moisture determination using the DICKEY-john Grain Analysis Computer GAC 2100 moisture meter are described in book II, chapter 1, section 1.10.

Certification. Record the percent of moisture on the certificate to the nearest tenth percent.

10.11 TEST WEIGHT

The weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device according to procedures prescribed in FGIS instructions.

Basis of Determination. Determine test weight before the removal of foreign material on a portion of sufficient quantity to overflow the kettle. The procedures for performing the test weight determination and available services are described in book II, chapter 1, section 1.11.

Certification. Record test weight results on the work record as displayed on the electronic scale or in whole and half pounds. Disregard fractions of a half pound. Record the test weight on the certificate in whole and half pounds. If requested, convert the pounds per bushel (lbs./bu) result to kilograms per hectoliter (kg/hl) using the following formula: $\text{lbs./bu} \times 1.287 = \text{kg/hl}$ and record in the "Remarks" section in whole and tenths.

10.12 INFESTED SOYBEANS

Infested soybeans are soybeans that are infested with live weevils or other live insects injurious to stored grain.

The presence of any live weevil or other live insects injurious to stored grain indicates the probability of infestation and warns that the soybeans must be carefully examined to determine if they are infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the soybeans are infested. Do not examine the file sample if the work portion is insect free.

Live weevils include rice weevils, granary weevils, cowpea weevils, maize weevils, and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, and larvae. (See Chapter 1, Section 1.2, Visual Grading Aids.)

Basis of Determination. Determine infestation on the lot as a whole or the sample as a whole. For insect tolerances, see table No. 4.

TABLE NO. 4

INSECT INFESTATION		
<i>Samples meeting or exceeding any one of these tolerances are infested: 2 lw, or 1 lw + 5 oli, or 10 oli</i>		
1,000-gram representative sample <u>1/</u> (+ file sample if needed)	Lot as a Whole (Stationary)	Online Sample (In-Motion) <u>2/</u>
Submitted samples Probed lots D/T sampled land carriers	Probed lots (at time of sampling)	Railcars under the Cu-sum Subsamples for Sacked Grain lots Components for Bargelots <u>3/</u> Components for Shiplots <u>3/</u>
<p><u>1/</u> Examine work portion and file sample if necessary. Do not examine file sample if work portion is insect free.</p> <p><u>2/</u> Minimum sampling rate is 500 grams per 2,000 bushels.</p> <p><u>3/</u> Minimum component size is 10,000 bushels.</p> <p><u>Key:</u> lw = live weevil, oli = other live insects injurious to stored grain</p>		

10.13 GARLICKY SOYBEANS

Soybeans that contain five or more green garlic bulblets or an equivalent quantity of dry or partly dry bulblets in a 1,000-gram portion.

Basis of Determination. Determine garlicky before the removal of foreign material on a portion of 1,000 grams. (Reference: Visual Reference Image Nos. [OF-13.0](#) and [OF-13.1](#))

Characteristics of Bulblets.

- a. Green garlic bulblets are bulblets which have retained all of their husks intact.
- b. Dry or partially dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.

NOTE: Wild onion, sometimes referred to as “crow garlic”, is considered as garlic.

Three dry or partly dry garlic bulblets are equal to one green bulblet.

Garlic bulblets apply in the determination of "Garlicky" but also function as foreign material.

Certification. When applicable, grade the soybeans "Garlicky" in accordance with Section 10.4, Special Grades. Upon request, record the number of garlic bulblets in whole and thirds.

10.14 PURPLE MOTTLED OR STAINED

Soybeans with pink or purple seed coats as determined on a portion of approximately 400 grams with the use of an FGIS Interpretive Line Print.

Purple mottled or stained is an appearance factor in soybeans and when sufficient amounts of discolored soybeans are found, the soybeans are considered purple mottled or stained.

Soybeans Discolored by the Growth of a Fungus. Soybeans discolored by a fungus have seed coats that are discolored pink or purple. This type of discoloration is caused by the growth of a fungus and may cover all or part of the kernel. Soybeans exhibiting this type of discoloration shall be considered purple mottled or stained. (Reference: [Interpretive line print.](#))

Soybeans Discolored by Dirt or a Dirt-Like Substance, Etc. This type of discoloration is caused by dirt or similar matter and includes nontoxic substances. Dirt, dirt-like substances, or other nontoxic substances are substances which can be readily removed by water. Soybeans exhibiting this type of discoloration shall be considered purple mottled or stained. (Reference: [Interpretive line print.](#))

Soybeans Purple Mottled or Stained by Pokeberry Stain. Soybeans with seed coats discolored by pokeberry stain are considered purple mottled or stained. (Reference: [Interpretive line print.](#))

Basis of Determination. Determine general appearance on the sample as a whole.

To assure a more uniform application of the general appearance factors in soybeans, it is recommended that the following procedures be followed:

- a. Cut out 400 grams of soybeans from the original sample.
- b. Pour the soybeans into an empty plastic box until the soybeans are level with the top of the box.
- c. Place the interpretive line print in the lid of the box.

- d. Compare the appearance of the soybeans in the plastic box with the appearance of the soybeans in the interpretive line print.
- e. Consider the soybeans purple mottled or stained when the soybeans in the box are equal to or worse in appearance than the soybeans in the interpretive line print. (Reference: [Interpretive line print.](#))

Certification. When applicable, grade the soybeans "Purple Mottled or Stained" in accordance with Section 10.4, Special Grades.

10.15 DISTINCTLY LOW QUALITY

Consider soybeans distinctly low quality when they are obviously of inferior quality and existing grade factors or guidelines do not accurately reflect the inferior condition.

Basis of Determination. Use all available information to determine whether the soybeans are of distinctly low quality. This includes a general examination of the soybeans during sampling and an analysis of the obtained sample(s).

Large Debris. Soybeans containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler and too large to enter the sampling device are considered distinctly low quality.

Other Unusual Conditions. Soybeans that are obviously affected by other unusual conditions which adversely affect the quality of the soybeans and cannot be properly graded by use of the grading factors specified or defined in the standards are considered distinctly low quality.

Soybeans suspected of containing diatomaceous earth are considered distinctly low quality unless the applicant specifically requests an examination to verify the presence of diatomaceous earth. If the laboratory examination verifies that the soybeans contain diatomaceous earth, then the soybeans are not considered distinctly low quality due to diatomaceous earth. Refer to Program Directive 9180.49, Grading and Certification of Grain Containing Diatomaceous Earth and Silica Gel, for additional information regarding the testing of soybeans for diatomaceous earth.

Certification. Grade distinctly low quality soybeans U.S. Sample Grade. Record the words "Distinctly Low Quality" and the reason(s) why in the "Remarks" section of the certificate.

10.16 U.S. SAMPLE GRADE CRITERIA

Basis of Determination. Determine additional U.S. Sample Grade criteria before the removal of foreign material based on a work portion of 1,000 - 1,050 grams. Table No. 5 shows the criteria and corresponding Visual Reference Images, tolerance limits, and the appropriate basis of determination. Consider identifiable pieces of grain, processed grain products (e.g., soybean meal, sorghum grits, corn meal, bulgur, etc.), or feed pellets in grain as foreign material. Unidentifiable materials or material unrelated to grain shall function as "unknown foreign substance."

Soybeans inoculated with a seed treatment which is toxic should not be confused with soybeans stained by pokeberry juice which is not toxic.

If it is difficult to visually determine soybeans stained by pokeberry juice from those stained by a seed treatment, the following procedures may be used:

- a. Place discolored soybean kernels into a 100 x 15 mm petri dish.
- b. Use an eyedropper to add enough hydrochloric acid (HCL) to cover the soybeans. Care should be taken not to get HCL in the eyes or on the skin.
- c. If the soybeans are stained with pokeberry juice, the HCL solution (0.1 N) will remove the stain from the seed coat and the soybeans are not graded U.S. Sample Grade. If the soybeans are stained with a toxic seed treatment, the HCL solution will not remove the stain from the seed coat and the soybeans are graded U.S. Sample Grade.

TABLE NO. 5

U.S. SAMPLE GRADE CRITERIA			
<i>Criteria</i>	<i>Visual Reference</i>	Number/Weight <u>1/</u>	
	<i>Image</i>	<i>Sample Basis</i>	<i>Lot Basis</i> <u>2/</u>
Any numerical grading factor		Excess of limit for U.S. No. 4	N/A
Animal filth	OF-1.0	10 or more	N/A
Castor Beans	OF-3.0	2 or more	N/A
Crotalaria seeds	OF-8.0	3 or more	N/A
Glass		1 or more	N/A
Odor		Presence	N/A
Stones		4 or more and in excess of 0.1% by weight	N/A
Unknown foreign substances <u>3/</u>	OF-31.0	4 or more	N/A
Heating		Presence	Presence
Total other material <u>4/</u>		11 or more	N/A
Large Debris *		N/A	2 or more
Other unusual conditions *		Presence	Presence

1/ Record count factors to the nearest whole number.

2/ The entire sample of a submitted sample is considered as the lot.

3/ Consider feed pellets and processed grain products as foreign material, not unknown foreign substance.

4/ Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, and unknown foreign substances. The weight of stones is not applicable for total other material.

* For Distinctly Low Quality, see section 10.15

Certification. Grade soybeans U.S. Sample Grade when one or more of the limits in table 5 are exceeded. Record the reason(s) why in the "Remarks" section of the certificate. Record count factors to the nearest whole number.

10.17 FOREIGN MATERIAL

All matter that passes through an 8/64 round-hole sieve and all matter other than soybeans remaining in the sieved sample after sieving according to procedures prescribed in FGIS instructions.

- a. Coarse Foreign Material. Coarse foreign material consists of the following:
- (1) Whole kernels of corn. Whole kernels of corn are kernels with one-fourth or less of the kernel removed.
 - (2) Cocklebur.
 - (3) Sticks if the following criteria are met:
 - (a) Approximately 1 inch or more in length.
 - (b) Approximately 1/2 inch or more with a thickness of 5/32 of an inch (width of the largest soybean slotted sieve).
 - (4) Pods (one-half pod or more). If pods contain soybeans, remove the soybeans and return to sample.
 - (5) Other coarse foreign material may include but is not limited to corn cobs, large feed pellets, pieces of dirt larger than soybeans, sweet corn, and edible beans that are generally larger than soybeans.
- b. Fine Foreign Material. Fine foreign material consists of the following:
- (1) Broken kernels of corn with more than one-fourth of the kernel removed.
 - (2) Popcorn, sunflower seed, and edible beans that are generally equal to or smaller than soybeans.
 - (3) Star thistles, star burs, sandburs, morning glory, and kinghead seeds.
 - (4) Sticks not meeting the criteria for coarse foreign material.
 - (5) Soybean pods less than one-half the total pod.
 - (6) Any other material too small to function as coarse foreign material. Soybean hulls which are not removed by the 3.175 mm (8/64) round-hole sieve are not considered foreign material.

Basis of Determination. Determine foreign material by handpicking and sieving as follows:

CHART 1 - PROCEDURE FOR DETERMINING FOREIGN MATERIAL

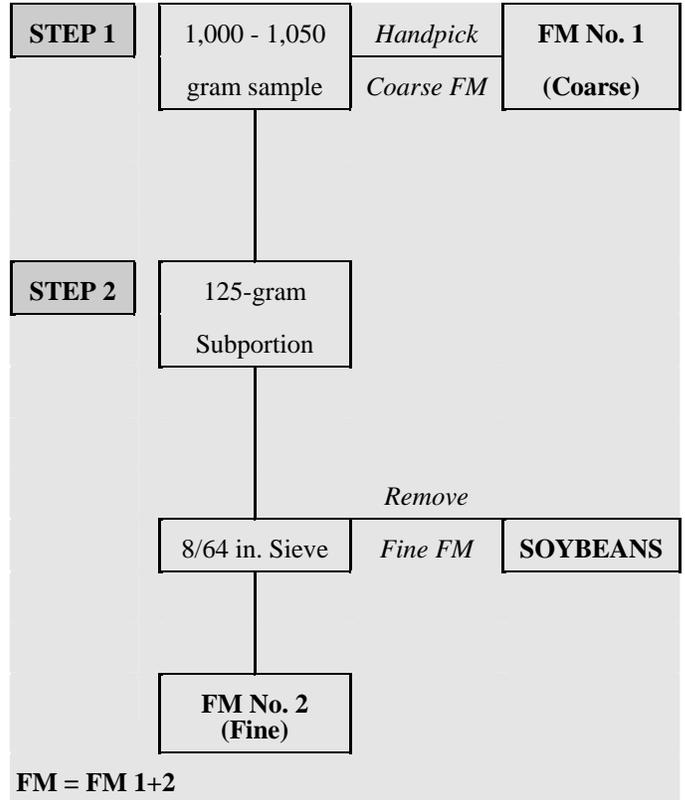
STEP 1. Coarse Foreign Material

Handpick the 1,000 – 1,050 gram portion for coarse foreign material. (Refer to section 10.17a for the definition of coarse foreign material)

STEP 2. Fine Foreign Material

- a. Cut down the cleaned sample (free of coarse foreign material) to a portion of 125 grams.
- b. Using an approved shaker or hand sieve, sieve (5 strokes) the 125-gram portion with an 8/64" (3.175 mm) round-hole sieve.
- c. Handpick the material other than soybeans from the material remaining on the 8/64" sieve and add it to the fine foreign material. Soybean hulls which remain on the 8/64" sieve are not considered foreign material.

NOTE: An 8/64 x 3/4 (3.175 x 19.050 mm) or 9/64 x 3/4 (3.572 x 19.050 mm) oblong-hole sieve, or 10/64 x 3/4 (3.969 x 19.050 mm) oblong-hole sieve may be mounted on top of the 8/64" round-hole sieve and used as an aid in separating splits. (See section 10.20 for the determination of splits.) When a sieve is used as an aid, the material remaining on top of the 8/64" round-hole sieve and the material remaining on top of the sieve used as an aid is analyzed for additional fine foreign material.



Computing Foreign Material. Compute foreign material in soybeans by adding the percentage of coarse foreign material to the percentage of fine foreign material in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

<u>Example</u>	
Weight of representative sample	1,025 grams
Weight of coarse foreign material	5.00 grams
Percentage of coarse foreign material (5.00 ÷ 1,025) x 100	0.48 percent
Weight of portion to be sieved	125 grams
Weight of fine foreign material	1.60 grams
Percentage of fine foreign material (1.60 ÷ 125) x 100	1.28 percent
Percentage of foreign material (0.48 + 1.28)	1.76 percent
rounded to:	1.8 percent

Certification. Record the percent of foreign material on the certificate to the nearest tenth percent.

10.18 PROCESSING THE WORK SAMPLE

At this point, determinations have been made for those tests that are performed prior to the removal of foreign material and the percentage of foreign material has been determined. Now the work sample is ready to be divided into fractional portions for those determinations required after the removal of the foreign material. The following chart and table No. 6 illustrate how the sample is divided into fractional parts using the Boerner divider.

CHART 2 - DIVIDING THE WORK SAMPLE

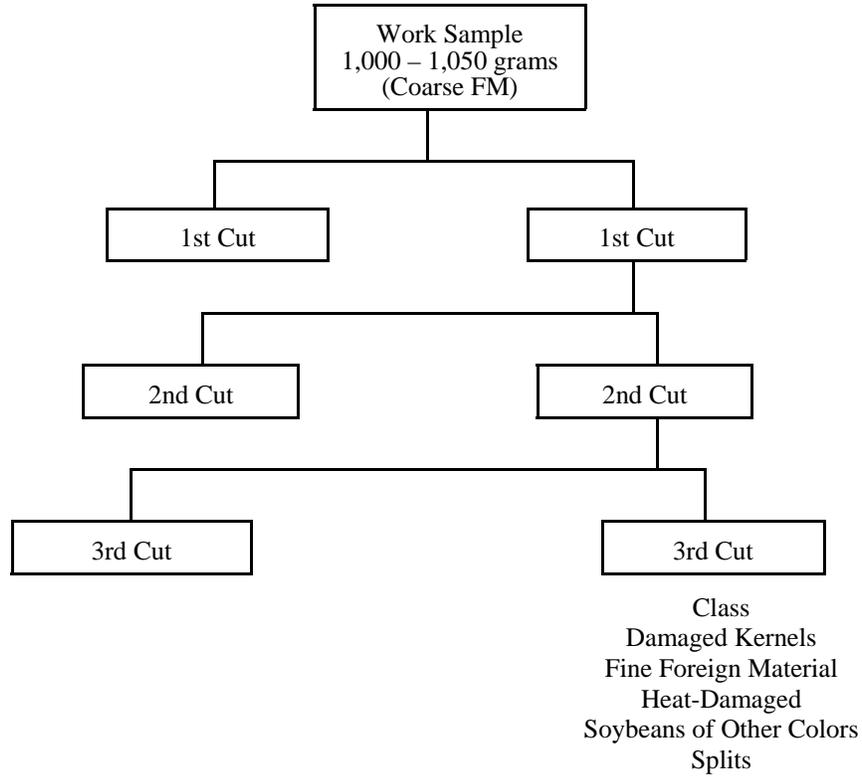


TABLE NO. 6

APPROXIMATE ANALYTICAL PORTION SIZES	
<i>Factors</i>	<i>Grams</i>
Damaged kernels	125
Foreign material	125
Heat-damaged kernels	125
Kind of grain <u>1/</u>	125
Soybeans of other colors	125
Splits	125

1/ Factor determined before the removal of foreign material.

10.19 CLASS

The two classes of soybeans are:

- a. *Yellow Soybeans. Soybeans that have yellow or green seed coats and which in cross section are yellow or have a yellow tinge, and may include not more than 10.0 percent of soybeans of other colors.*
- b. *Mixed Soybeans. Soybeans that do not meet the requirements of the class Yellow soybeans.*

Basis of Determination. Determine class by the color characteristics of the kernels on a portion of 125 grams after the removal of foreign material.

Soybeans of Other Colors. Soybeans that have green, black, brown, or bicolored seed coats. Soybeans that have green seed coats will also be green in cross section. Bicolored soybeans will have seed coats of two colors, one of which is brown or black, and the brown or black color covers 50 percent of the seed coats. The hilum of a soybean is not considered a part of the seed coat for this determination. (Reference: Visual Reference Image No. [SB-12.0](#))

Soybeans of other colors is not a class of soybeans.

Soybeans with green seed coats that are yellow when cross sectioned are considered Yellow soybeans.

Yellow or Green soybeans with distinct black or brown pigmented streaks or splotches covering 50 percent or more of the seed coat are considered bicolored soybeans.

Black or Brown soybeans with distinct yellow or green pigmented streaks or splotches covering 50 percent or more of the seed coat are considered bicolored soybeans.

Certification. For Mixed soybeans, record the percent of Yellow soybeans and soybeans of other colors in the "Remarks" section of the certificate to the nearest tenth percent.

When not a mixture, record the percent of "soybeans of other colors," in the appropriate factor results section of the certificate to the nearest tenth percent.

10.20 SPLITS

Soybeans with more than one-fourth of the bean removed and that are not damaged. (See Section 10.21, Damaged Kernels.)

Basis of Determination. Determine splits on a portion of 125 grams after the removal of foreign material.

Note: A smaller portion size (approximately 60 grams) may be used for the analysis of splits when a sample contains approximately 50 percent or more of whole soybeans that pass through a 10/64 oblong-hole sieve.

Sieves used to Facilitate the Splits Determination. An 8/64 x 3/4 (3.175 x 19.050 mm) or 9/64 x 3/4 (3.572 x 19.50 mm) oblong-hole or 10/64 x 3/4 (3.969 x 19.50 mm) oblong-hole hand sieve may be used to separate splits. Use these sieves in conjunction with the 8/64 inch round-hole sieve used to determine foreign material. (See Section 10.17, Foreign Material.)

All splits are not separated by sieving. Therefore, the material remaining on top of the sieve and the material that passed through the sieve have to be examined for splits.

Since splits are normally separated during the determination of foreign material, the weight of the foreign material must be subtracted from the weight of the representative portion before calculating the percentage of splits.

<u>Example</u>	
Weight of representative portion	125 grams
Weight of fine foreign material (material passing through the 8/64 round-hole sieve and all matter other than soybeans on top of the sieve)	2.40 grams
Weight of splits	10.60 grams
Weight of portion used to calculate splits 125 – 2.40 (rounded for subtraction to 2)	123 grams
Percentage of splits (10.60 ÷ 123) x 100	8.61 percent
rounded to:	8.6 percent

Certification. Record the percent of splits on the certificate to the nearest tenth percent.

10.21 DAMAGED KERNELS

Soybeans and pieces of soybeans that are badly ground-damaged, badly weathered-damaged, diseased, frost-damaged, germ-damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, stinkbug-stung, or otherwise materially damaged. Stinkbug-stung kernels are considered damaged kernels at the rate of one-fourth of the actual percentage of the stung kernels.

Basis of Determination. Determine the amount of damaged kernels on a portion of 125 grams after the removal of foreign material.

Note: A smaller portion size (approximately 60 grams) may be used for the analysis of damaged kernels when a sample contains approximately 50 percent or more of whole soybeans that pass through a 10/64 oblong-hole sieve.

TYPES OF SOYBEAN DAMAGE.

In general, a soybean is considered damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

Badly Ground and/or Weather-Damaged Kernels. Soybeans and pieces of soybeans in which the seed coats are discolored by ground or weather damage. The discoloration may be on one side or both sides. (Reference: Visual Reference Image Nos. [SB-1.0](#) and [SB-1.1](#))

Damaged-by-Heat Kernels. Soybeans and pieces of soybeans which have been damaged by heat but are not heat damaged. Often it is necessary to cross section the whole soybean to determine the extent of the damage. Do not cross section splits and pieces of soybeans. (Reference: Visual Reference Image No. [SB-2.0](#))

Frost-Damaged Kernels (Green). Soybeans and pieces of soybeans which are discolored green in cross section. (Reference: Visual Reference Image No. [SB-3.0](#))

Frost-Damaged Kernels (Waxy). Soybeans and pieces of soybeans which have a glassy or wax-like appearance. (Reference: Visual Reference Image No. [SB-3.2](#))

Heat-Damaged Kernels. Soybeans and pieces of soybeans which are materially discolored and damaged by heat. Often kernels need to be cross sectioned to determine the extent of damage. Do not cross section splits and pieces of soybeans. (Reference: Visual Reference Image No. [SB-5.0](#))

Immature Kernels (Wafers). Cross section soybeans and pieces of soybeans that are immature and have a thin, flat, wrinkled, or wafer-like appearance to determine if there is "meat" in the kernel. If there is "meat" in the kernel and the "meat" is not otherwise damaged, the wafers are sound. Wafered kernels with no "meat" are considered damaged. (Reference: Visual Reference Image No. [SB-6.0](#))

Mold-Damaged Kernels. Soybeans and pieces of soybeans which contain mold. (Reference: Visual Reference Image Nos. [SB-8.0](#) and [SB-8.1](#))

- a. Invaded-by-Mold. Soybeans that are discolored; distorted; misshapen; elongated; not normal in size or shape; may have splits, cracks, or fissures in the seed coat and which contain a white to gray moldy growth. Soybeans and pieces of soybeans with mold on exposed areas (meat), regardless of amount, are considered damaged. (Reference: Visual Reference Image No. [SB-8.0-A](#))
- b. Surface Mold Growth. Soybeans with little or no apparent deterioration having a milky white or grayish crusty growth caused by downy mildew. Seedcoat is not discolored and contains no splits, cracks, or fissures. **SOYBEANS THAT CONTAIN MILDEW ON 50 PERCENT OR MORE OF THE SEEDCOAT IN SUFFICIENT CONCENTRATION TO MEET OR EXCEED THE MINIMUM SHOWN SHALL BE CONSIDERED DAMAGE.** (Reference: Visual Reference Image [SB-8.0-B](#))
- c. Mold Damage (Pink). Soybeans and pieces of soybeans with a pink discoloration caused by fungal activity. (Reference: Visual Reference Image No. [SB-8.1](#))

Mold-Like Substance. Whole soybeans which are 50 percent or more covered and pieces of soybeans which are discolored, to any degree, and contain 50 percent or more coverage with a mold-like substance. In either instance, the mold-like substance present must be sufficiently concentrated to meet the minimum thickness or density shown on Visual Reference Image No. [SB-8.0, kernel B](#).

Sprout-Damaged Kernels. Soybeans and pieces of soybeans which are sprouted (with the sprout protruding). (Reference: Visual Reference Image No. [SB-9.0](#))

Insect-Bored Kernels. Soybeans and pieces of soybeans which bear evidence of boring or tunneling, indicating the presence within the kernels of insects and kernels in which noticeable weevil-bored holes have been eaten. Kernels which have been partially eaten by insects or rodents but which are entirely free from refuse, webbing, insects, or other forms of damage are considered as sound kernels. Do not cut open the kernel when making this determination. (Reference: Visual Reference Image No. [SB-7.0](#))

Stinkbug Stung Kernels. Soybeans and pieces of soybeans which show an indentation or discoloration on the seed coat are considered as being stung by stinkbugs. It is necessary, in most cases, to cross section kernels to determine the extent of damage. Stinkbug stung kernels should not be confused with kernels that are damaged by weevils, etc. (Reference: Visual Reference Image No. [SB-10.0](#))

Stinkbug stung kernels are considered damaged at the rate of one-fourth of the actual percentage.

Computing Damaged Kernels. Obtain the percentage of total damaged kernels by adding the percentage of other damaged kernels and stinkbug damaged kernels. Add the results, as shown in the following example, in hundredths (disregard thousandths) and round the sum to the nearest tenth percent.

<u>Example</u>	
Weight of representative portion (after removal of FM)	123 grams
Weight of other damaged kernels	1.60 grams
Weight of stinkbug damage	15.00 grams
Percentage of other damaged kernels: (1.60 ÷ 123) x 100	1.30 percent
Percentage of stinkbug damage: (15.00 ÷ 123) x 100 ÷ 4	3.04 percent
Damaged kernels (total) (1.30% + 3.04%)	4.34 percent
rounded to:	4.3 percent

Certification. Record the percent of damaged kernels on the certificate to the nearest tenth percent.

10.22 HEAT-DAMAGED KERNELS

Soybeans and pieces of soybeans that are materially discolored and damaged by heat.

Basis of Determination. Determine heat-damaged kernels on a portion of 125 grams after the removal of foreign material.

When determining heat-damaged kernels, refer to Section 10.21, Damaged Kernels, and Visual Reference Image No. [SB-5.0](#).

Certification. Record the percent of heat-damaged kernels on the certificate to the nearest tenth percent.

10.23 OFFICIAL CRITERIA

Official criteria factors are determined only on request and do not affect the grade designation.

- a. Oil and/or Protein. An applicant may request analysis for oil, protein, or oil and protein content.

Basis of Determination. All oil and protein analyses shall be performed in accordance with official procedures established by the Grain Inspection, Packers and Stockyards Administration.

Certification. Refer to the NIRT Handbook and the Grain Inspection Handbook, Book III, for certification procedures.

- b. Sclerotinia Sclerotiorum. The fungus S. sclerotiorum causes a stem disease (stem rot) in soybeans which results in large black growths (sclerotia) on the stem and pods. Seeds may occasionally become infected within diseased pods. If infected early, the seeds are flattened and badly shriveled and are sometimes replaced by sclerotia.

Basis of Determination. Examine the work portion, 1,000 – 1,050 grams, for the presence of S. sclerotiorum.

When determining the presence of S. sclerotiorum, refer to Visual Reference Image No. [OF-32.0](#).

Certification. Record the percentage of S. sclerotiorum to the nearest tenth in the "Remarks" section of the certificate.

c. Black Soybeans. Soybeans that have black seed coats.

Basis of Determination. Determine the percentage of black soybeans on the color characteristics of the kernels on a 125-gram portion after the removal of foreign material.

Certification. Record the percentage of black soybeans to the nearest tenth in the "Remarks" section of the certificate.

d. Seed Sizing. Consists of a measurement of soybeans passing through or remaining on top of a sieve(s) size specified by the applicant for service.

Basis of Determination. Determine seed sizing on a portion of 125 grams, after the removal of foreign material, using one of the following methods:

1. Mechanical Sieving Method.

- (a) Mount the sieve and the bottom pan on the mechanical sieve shaker.
- (b) Set the stroke counter to 20 strokes.
- (c) Follow the procedures describe in book II, chapter I, Section 1.12, Mechanical Sieve Shaker.
- (d) All soybeans passing through or remaining on top of the sieve(s) will determine the percentage of size fractions.

2. Hand Sieving Method.

- (a) Mount the sieve on the bottom pan.
- (b) Hold the sieve level in both hands with elbow close to the body.

- (c) In a steady motion, move the sieve from left to right approximately 10 inches and then return from right to left.
- (d) Repeat this operation 20 times.
- (e) All soybeans passing through or remaining on top of the sieve(s) will determine the percentage of the size fractions.

Example

Weight of representative portion	125 grams
Weight of foreign material	2.87 grams
Sample weight for determining seed sizing 125 grams – 3 grams (2.9 grams rounded)	122 grams
Weight of material remaining on top of sieve	50.0 grams
Weight of material passing through sieve	72.0 grams
Percent remaining on top of sieve (50 ÷ 122) x 100	40.98 percent
rounded to:	41.0 percent
Percent passing through sieve (72 ÷ 122) x 100	59.02 percent
rounded to:	59.0 percent

Certification. Record the percentage of the size fractions, as requested by the applicant, to the nearest tenth on the work record and in the “Remarks” section of the certificate using the following statement:

“ _____ % passing through (a specified round-hole sieve).”

“ _____ % remaining on top of (a specified sieve).”

- e. Seed Count. A measurement of the number of soybeans contained in a specified weight (i.e., number of soybeans per 1,000 grams, one pound, etc.)

Basis of determination. Determine the count on a representative portion of 25 grams as illustrated below, after the removal of foreign material and non-whole soybeans (soybeans with more than one-fourth of the bean removed).

	<u>Example</u>	
Weight of representative portion		25.00 grams
Weight of foreign material		0.87 grams
Weight of non-whole soybeans		2.93 grams
Weight of whole soybeans		21.00 grams
[$25 - (0.87 + 2.93) = 25 - 4$ (rounded)]		
Count of whole soybeans		172
Average count per gram ($172 \div 21$)		8.19
(Truncated – disregard thousands)		
Seed count per 1,000 grams		8,190
$8.19 \times 1,000$		

Certification. Record the seed count on the work record and in the “Remarks” section of the certificate using the following statement:

“(count) whole soybeans (per specified amount).”

- f. White Hilum. A test to determine the percent of whole soybeans with clear white hilum. Upon request, tests for other hilum colors (buff, brown, etc.) can be provided.

Basis of Determination. Determine the percentage of clear white hilum on a portion of 125 grams after the removal of foreign material and non-whole soybeans (soybeans with more than one-fourth of the bean removed).

	<u>Example</u>	
Weight of representative portion		125 grams
Weight of foreign material		2.36 grams
Weight of non-whole soybeans		4.69 grams
Weight of whole soybeans		118.0 grams
[$125 - (2.36 + 4.69 \text{ rounded}) = 125 - 7$]		
Weight of non-clear white hilum		1.55 grams
Weight of clear white hilum soybeans		116.0 grams
$118 - 2$ (1.55 rounded)		
Percent of whole soybeans		94.40 percent
$(118 \div 125) \times 100$		
Percent of clear white hilum soybeans		98.30 percent
$(116 \div 118) \times 100$		

Certification: Record the percent of whole soybeans and the percent of clear white hilum soybeans to the nearest tenth percent in the “Remarks” section of the certificate using the following statement:

“Sample contains 94.4% of whole soybeans of which 98.3% are clear white hilum soybeans.”

- g. Cracked Seedcoats. A test to determine the percent of cracked seedcoats of sound soybeans.

Basis of Determination. Determine the percentage of cracked seedcoats on a portion of 125 grams after the removal of foreign material and damaged kernels. Soybeans with cracked seedcoats shall be whole (three-fourths or more of a whole soybean) sound soybeans which have readily discernable cracked seedcoats, or have all or part of the seedcoat removed.

	<u>Example</u>
Weight of representative portion	125 grams
Weight of foreign material	3.85 grams
Weight of damaged soybeans	1.98 grams
Weight of split soybeans	17.90 grams
Weight of whole soybeans [125 – (3.85 + 1.98 + 17.90) = 125 – 24 (rounded)]	101.0 grams
Weight of whole soybeans with cracked seedcoats	17.50 grams
Percent of whole soybeans with cracked seedcoats (17.50 ÷ 101) x 100	17.32 percent
rounded to:	17.3 percent

Certification: Record the percentage of cracked seedcoats in the “Remarks” section of the certificate to the nearest tenth percent.

“Contains _____% of cracked seedcoat soybeans.”

- h. Shriveled and Wrinkled Soybeans. Whole non-damaged soybeans with an atypical size and appearance that pass through a 10/64" x 3/4" oblong-hole sieve and remain on top of the 8/64" round-hole sieve.

Basis of Determination. Determine shriveled and wrinkled soybeans after the removal of foreign material on a representative portion of 125 grams.

Example

Weight of representative portion	125 grams
Weight of foreign material	2.57 grams
Weight of damaged soybeans	1.46 grams
Weight of split soybeans	15.00 grams
Weight of whole soybeans that passed through a 10/64" x 3/4" oblong-hole sieve and remain on top of the 8/64" round-hole sieve. $125 - (2.57 + 1.46 + 12.90) = 125 - 17$ (rounded)]	108.0 grams
Weight of whole shriveled and wrinkled soybeans	24.88 grams
Percent of whole shriveled and wrinkled soybeans $(24.88 \div 108) \times 100$	23.03 percent
rounded to:	23.0 percent

Certification. Record to the nearest tenth percent in the "Remarks" section of the certificate.