



# Practical Sorghum Sampling and Hand Sieving Procedures

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This publication provides practical procedures which can be used by producers, warehouse managers, and elevator managers for sampling and grading sorghum. The procedures and portion sizes are based on the USDA Practical Procedures for Grain Handlers. The portions and hand sieving methods presented in this Current Report are not used by official grain inspectors licensed by the Federal Grain Inspection Service. Licensed graders must use larger portions and precision mechanical equipment that will provide the most accurate and most uniform results.

## Representative Sample

Obtaining a representative grain sample is an essential part of grain inspection. Without a representative sample, the final grade will not reflect the true grade or value of the grain. In order for a sample to be considered representative, it must

1. be obtained in accordance with recommended procedures;
2. be of the prescribed size (at least 1000 grams or approximately 1 1/4 quart); and
3. be handled securely, protected from manipulation, substitution, and careless handling.

The following pages explain the proper way to do probe sampling. Some of this information was taken from Inspecting Grain-Practical Procedures for Grain Handlers, Section 1, Sampling Grain.

## Probe Sampling

A large percentage of grain, as it travels from the farm to the final consumer, is at one time or another sampled with a grain probe. Probe sampling is the only approved method for obtaining samples from stationary lots. If probe sampling is performed correctly, the samples drawn will consistently be representative.

## The Equipment

Before learning the sampling procedure, the sampler should become familiar with the equipment used.

### 1. Hand Probe

This standard piece of equipment, sometimes referred to as a trier, is constructed of brass or aluminum. Probes come in various sizes with standard lengths of 5, 6, 8, 10, and 12 feet. The type of carrier dictates which probe length shall be used. There are two types of hand probes: compartmented probes, in which slots in the outer tube match compartments in the inner tube, and open throat probes, in which the inner tube is open. Open-throat probes tend to draw more of their sample

from the top portion of the grain, while compartmented probes draw a representative sample from each layer. All official grain probes are compartmented probes with an outer tube that is 1 3/8 inches in diameter.

Make sure the probe reaches the bottom of the carrier. A 5 or 6-foot probe will be sufficient for most farm trucks while hopper-bottom carriers may require a longer (6, 8 or 10-foot) probe.

### 2. Mechanical probe

There are two types of mechanical probes which are recommended for sampling stationary lots of grain in trucks, railcars, or other open-top carriers. The gravity-fill probe function is similar to compartmented hand probes except that after the compartment is filled it rotates to an inner tube where it is forced up by air. The core probe functions by forcing the sample up into the core as the probe is pushed down and then using air to transport the sample to the output point. A third type, the in-load suction probe, which uses negative air pressure to suck the sample into the bottom of the probe, is not recommended since it tends to overestimate foreign material.

### 3. Sampling Canvas

Heavy canvas cloth or similar material can be used to display the sample from the compartmented probe. Another alternative is a short section of rain gutter or half section of pipe. The sampling canvas or other material should be at least 6 inches longer than the probe used to draw the sample. This size is necessary so that the grain from the entire length of each probe will not spill off the ends of the canvas. Sampling canvases must always be kept clean, dry, and free of holes.

### 4. Sampling Containers

Containers such as heavy cloth or canvas bags and metal buckets or plastic cans may be used to transport the sample to the inspection station. Sample containers should be free of all old grain, insects, and other waste material prior to use. Airtight containers or bags lined with a polyethylene liner should be used to store grain to prevent loss of moisture and to protect the sample from adverse environmental conditions such as rain or humid weather.

## General Procedures

Before sampling any carrier, record on your sample ticket the carrier's identification number. Visually examine the whole lot of grain. Take a handful of grain from several locations and check it for odor. Record any unusual conditions on your sample ticket. Next, spread your canvas and check to see that

the probe and canvas are clean and dry. You are now ready to start sampling.

There are several ways to insert the probe into the grain. Regardless of which technique you use, the general rules are

1. Insert the probe at a 10 degree angle from the vertical with the slots facing upward and completely closed. The 10 degree angle eases the resistance of the compacted grain against the probe while still allowing the probe to reach the bottom of the container. The slots must be kept closed until the probe is inserted as far as it will go. Otherwise, a disproportionate amount of grain from the top of the load will fall into the probe compartments as it is being inserted. When sampling grain which contains sand or grit, insert the probe with the slots downward to avoid jamming it. After the probe is inserted, turn the slots upward before opening.
2. After the probe is fully inserted (with the slots facing upward), open the slots and move the probe up and down quickly in two short motions. Close the slots completely, grasp the probe by the outer tube, and withdraw it from the grain. Do not pull the probe by the wooden handle. This can result in the inner tube being pulled out of the outer tube. When this occurs, the probe must be emptied, reassembled, cleaned, and the area probed again.
3. Empty the probe onto the canvas and compare the grain from each depth of the probe for uniformity of kind, condition, and infestation. Also, compare the probe to others drawn from the same lot. If all probes and portions of probes are uniform with one another, they shall be composited and placed in a sample bag along with a completed sample ticket. If the examination of the probes indicates that the lot of grain is made up of distinctly different parts in regard to condition, then draw a sample from each of the different parts, in addition to the sample that represents the carrier as a whole.
4. When transferring the grain from the canvas to the sampling bag, take care not to allow fine material to be blown from the canvas.

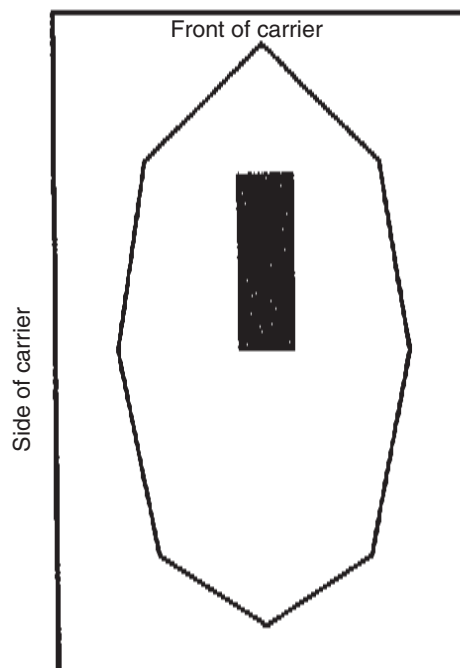
### Where to Probe

Draw at least two samples from any truck or trailer that carry 600 bushels or less. Larger lots of grain should be probed in 3 to 5 places. Recommended probe sites, which are shown in Figure 1, are anywhere in the carrier except the corners and the center of the load (which was directly underneath the loading spout). The probe sites should be varied between loads in a random manner. Elevators which routinely sample in the same location have found that bad grain seems to migrate to the areas in the load which are not sampled. Hopper bottom carriers should be probed in the center of each hopper (Figure 2).

### Inspection Procedures

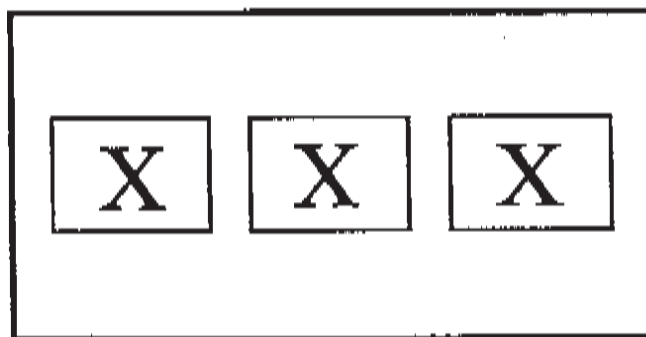
The process of inspecting sorghum begins when the sample is drawn and follows a prescribed path:

1. Obtain a representative sample of approximately 1,000 grams.
2. Examine the sample for objectionable odors, insect infestation, heating, or other harmful conditions.
3. Divide out a 250-gram portion and determine the moisture content.
4. Determine the test weight.
5. Recombine the 250-gram portion and test the entire sample for dockage.
6. Determine the percentage of broken kernels, foreign material and other grain.



\* Draw at least two probe samples from any point in the shaded

**Figure 1. Sampling Sites-Truck or Trailer.**



Draw probe samples from the points marked with an X. Avoid probing in the sprout-lines.

**Figure 2. Sampling Sites—Hopper Bottomed Carriers.**

7. When deemed necessary, divide out 125-gram portions for the determination of broken kernels, foreign material, and other grain and damage.

#### Step 1—Obtain a Representative Sample

Use the probing procedures described above, or a tailgate sampler or other method, to obtain a representative sample of approximately 1000 grams.

#### Step 2—Objectionable Odors, Insects, and Harmful Conditions

Except for smut or garlic odors, sorghum which has a musty, sour, or commercially objectionable foreign odor (COFO) is “U.S. Sample grade.” Use the entire sample to determine odor. Fumigant or insecticide odors are not considered COFO if they dissipate after aerating the sample for up to 4 hours. The presence of two or more live insects injurious to stored grain causes the grain to be designated “infested” but does not affect the numerical grade. Heating is a condition common to grain which is spoiling and also causes the grain to be designated “U.S. Sample grade.” Be careful not to confuse heating with sound grain which is warm due to storage in bins, railcars, or other containers during hot weather. Other harmful substances which can cause the grain to be considered “U.S. Sample grade” include castor beans, cockleburs, crotalaria seeds, glass, stones, and unknown foreign substances such as rock salt or fertilizer.

### Step 3—Moisture

Moisture is an essential measure of sorghum storability and value and should be determined prior to removing dockage. Moisture can be determined with any device which has been tested and approved by the Oklahoma Department of Agriculture. Moisture meters should be certified once a season and maintained in adherence with the manufacturer’s recommendation. Many moisture meters (such as the Montomco) require that a specific weight sample be used. The use of an approximate sample weight will result in an inaccurate measure of moisture content. Additionally, some of the newer moisture meters also display an estimate of test weight. This test weight estimate cannot be legally used in determining grade since it is based on a small sample size (often 100 grams or less).

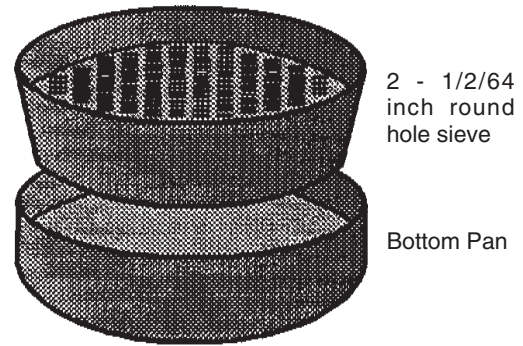
### Step 4—Determining the Test Weight

Test weight is a measure of the weight of grain required to fill a specific volume (pint, quart, or bushel). To determine test weight, pour the entire dockage-free sample through a funnel into a kettle until the grain overflows the kettle. Level off the kettle making three, full-length, zigzag motions with a stroker. The test weight is determined by weighing the filled kettle on either a special beam scale, an electronic scale programmed to convert gram weight to test weight, or a standard laboratory scale. If a standard scale is used, the gram weight must be converted to test weight per bushel. (Multiply the grams in a one-quart kettle by 0.0705 to obtain the test weight in pounds per bushel.)

### Step 5 (a)—Determination of Dockage in Sorghum Using Hand Sieves

The entire sample (approximately 1000 grams) should be used to determine the level of dockage. Sorghum dockage is certified in whole percents with a fraction of a percent discarded (1.00 to 1.99 is recorded as 1.0%). Dockage is weed seeds, weed stems, chaff, straw, grain other than sorghum, sand, dirt, and any other material other than sorghum, which can be removed readily from sorghum by use of appropriate sieves. Following are the guidelines for hand sieving to determine dockage (Figure 3).

1. Record the weight of sample used (approximately 1000 grams).
2. Assemble a 2-1/2/64 round-hole sieve on top of a round pan.
3. Sieving only about 1/4 of the sample at a time, shake the sorghum vigorously for the material to pass through the sieve.
4. After the complete sample is sieved, weigh the material that passes through the 2-1/2/64 round-hole sieve to determine the percent of dockage.



Sieve for 20 strokes. Dockage is all the material which passes through the sieve and falls in the bottom of the pan.

**Figure 3. Determining Dockage in Sorghum Using Hand Sieves.**

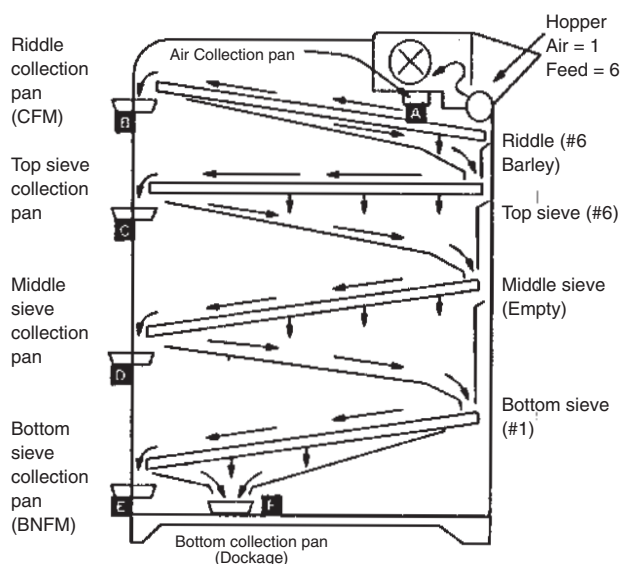
### Step 5 (b)—Determination of Dockage With a Mechanical Dockage Tester

1. Record the weight of sample used (approximately 1000 grams).
2. Clean the dockage tester, insert the appropriate sieves (#6 sieve in the top carriage and #1 sieve in the bottom carriage for a Carter Day Dockage Tester<sup>1</sup>), insert the appropriate riddle (#6 barley riddle on a Carter Day Dockage Tester), and make adjustments recommended by the manufacturer which give results comparable to FGIS standard equipment (air=1, feed=#6 on a Carter Day Dockage Tester).
3. Turn on the tester and pour the sample into the hopper.
4. After the sample has cleared the last sieve, turn the tester off.
5. Remove and weigh the dockage, which is considered to be all material which passes through the bottom #1 sieve on a Carter Day Dockage Tester (pan F in Figure 4).
6. Remove and weigh the foreign material, which, on a Carter Day Dockage Tester, is all coarse material that passes over the riddle (pan B in Figure 4) along with all material other than sorghum which is handpicked from the mechanically cleaned sample.
7. Remove and weigh the broken kernels, foreign material, and other grains (BNFM), which is all material that passes through the #6 top sieve but stays on top of the #1 bottom sieve (pan E in Figure 4).

### Step 6—Determination of Broken Kernels, Foreign Material, and Other Grain Using Hand Sieves

USDA grade requirements for sorghum include the percentage of broken kernels, foreign material, and other grains (BNFM). If the percentage of BNFM is 4% or above, the grain is not USDA #1 Sorghum and may be discounted. If the percentage of damaged kernels is 2% or above, the sorghum cannot be USDA #1. The determination of broken kernels, foreign material, and other grains is based on the portion used in determining dockage after the dockage has been removed. Following is a procedure to determine the percentage of broken kernels, foreign material, and other grains (Figure 5).

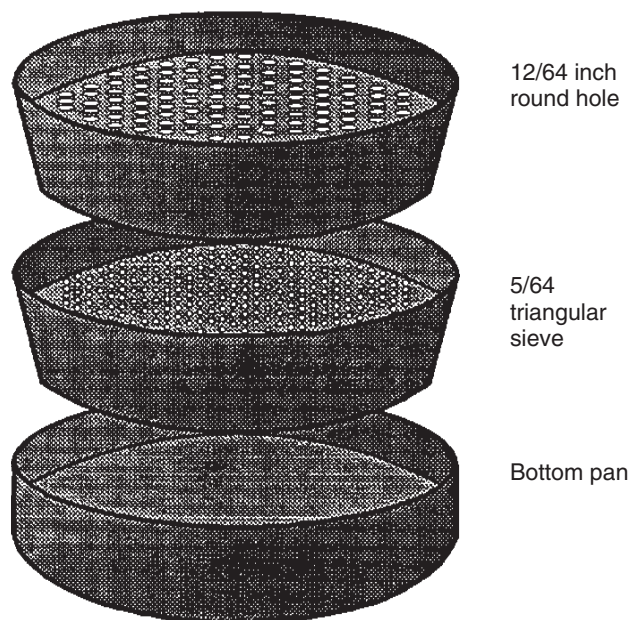
<sup>1</sup> The Carter Day Dockage Tester is the only machine currently used by FGIS for official inspections. However several brands of mechanical dockage testers provide similar results. References to the Carter Day Dockage Tester are provided for illustration purposes only and should not be interpreted as any form of endorsement.



BNFM is all material remaining on top of the 12/64 round-hole sieve (top sieve), plus all material passing through the 5/64 triangular sieve and falling in the bottom pan, plus all material other than sorghum handpicked from the material remaining on top of the 5/64 triangular (middle) sieve.

**Figure 4. Set-up Procedure for Carter Day Dockage Tester Standard Set-up for Sorghum.**

1. For sieving, assemble a 5/64 triangular sieve on a bottom pan and then place a 12/64 round-hole sieve on top of the 5/64 sieve.
2. Sieving only about 1/4 of the sample at a time, shake the sorghum vigorously for the material to pass through the sieves.
3. After the complete sample has been sieved, the BNFM is
  - a. The material, other than sorghum, on top of the 12/64 round-hole sieve;
  - b. plus, the material which passed through the 5/64 triangular sieve and fell in the bottom pan;
  - c. plus, all material other than sorghum handpicked from the material remaining on top of the 5/64 triangular (middle) sieve.
4. Determine the percentage of BNFM by dividing the amount of BNFM in steps 3a-3c by the total sample weight. If the grader wishes to avoid handpicking the entire amount which remains on top of the middle sieve, an alternative procedure is described in steps 5-6.
5. Run material left on top of the 5/64 triangular sieve through a divider to obtain an approximate 30-gram portion. (Record the exact weight of the sample used.)
6. Remove all materials other than sorghum, which include detached hulls and non-grain sorghum, from the 30-gram portion by hand picking. Determine the percentage of handpicked foreign material by dividing the weight of the handpicked material by the portion (approximately 30 grams) weight.



BNFM-All material remaining on top of the 12/64 round hole sieve (top sieve) plus, all material passing through the 5/64 triangular sieve and falling in the bottom pan plus, all material other than sorghum hand picked from the material remaining on top of the 5/64 triangular (middle) sieve.

**Figure 5. Determining broken kernels, foreign materials and other grains (BNFM) using hand sieves.**

7. In official grading, a mathematical formula is used to determine the total percent of broken kernels, foreign material, and other grains. However, for simplicity, the percentages of the handpicked foreign material can be added to the sieved foreign material found in 3a. and 3b. to get a close estimate of the total BNFM.

### Step 6—Determination of Broken Kernels, Foreign Material, and Other Grain with a Mechanical Dockage Tester

(Refer to determination of dockage with a mechanical dockage tester, described above).

### Step 7—Determination of Damage

The percentage of heat damaged and damaged kernels is determined by handpicking a 125-gram sample. The most common types of kernel damage are germ, frost, heat, mold, purple pigment, and insect damage.

## Summary

It is important that grain handlers concentrate on determining the correct grade. Profit margins are too small to lose money because of improper grade determination. The procedures presented in this Fact Sheet are not designed to produce official grades. The procedures should produce relatively accurate estimates of dockage, foreign material, damaged kernels, and other factors affecting grades and the value of the grain.

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