



How to Store a Billion Beans [Language Arts]

Objectives:

1. Students will develop an understanding of how a grain elevator operation works.
2. Students will be able to define terms related to grain storage and transportation.

Common Core Standards:

- RI.4.1 Refer to details and examples in the text when explaining what it says explicitly and when drawing inferences from the text.
- RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in the text relevant to a grade 4 topic or subject area.
- RI.4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in the text or part of the text.
- RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
- RF.4.4 Read with sufficient accuracy and fluency to support comprehension.
- L.4.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.

Materials Needed:

- *How to Store a Billion Beans* background information (teacher)
- *Grain Storage: Bushels of Beans and Corn* photo – project for class to see or distribute copies for pairs of students to view
- vocabulary matching cards
- *Show What You Know about Grain Storage* worksheet
- optional: computer and projector to show Pod to Plate Video Episode IV – “Elevators and Trains” (available online at www.podtoplate.org)



Procedure:

1. Project the *Grain Storage: Bushels of Beans and Corn* photo for the class to see. Alternatively, distribute copies of the photo for pairs of students to view and the *How to Store a Billion Beans* information sheet. Use the information sheet *How to Store a Billion Beans* to explain the photo. Be sure to emphasize vocabulary words during the explanation.
2. Show students the vocabulary matching cards. Explain that each student will receive either a vocabulary term or a definition. Once all cards have been distributed, students should use what they learned during the photo discussion to find their partner.
3. Pass out cards. If the bonus terms are used, there are enough cards for 30 students. Otherwise, there are enough for 24. If there are an uneven number of students, the teacher may participate in the matching activity.
4. When all students have found their partners, invite each pair to come forward and read their vocabulary term and definition. Challenge the class to decide whether each term and description is correctly matched.

Evaluation:

- Allow students to work with their partners or individually to complete the *Show What You Know about Grain Storage* worksheet.



Vocabulary List for Pod to Plate Video Episode #4 – Elevators & Trains

bin – large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin

bushel – unit of weight used to measure grain or any dry material

control room – where computerized controls at an elevator are located; manages where grain is stored, operation of the grain dryer, and the condition of the stored grain

dump pit – large underground area at a grain elevator into which grain is dumped to then be lifted into the bins or buildings for storage

elevating leg – vertical steel structure containing a series of connected rectangular buckets which scoop grain from an underground pit and lift it up to be dumped into pipes leading to storage bins; also known as a grain leg

grain dryer – huge machine used to dry grain crops before storage to prevent the grain from spoiling

grain elevator – a grain storage facility which uses a system of connected buckets to scoop grain from underground pits and lift or elevate it up to be dumped into the correct building or bin; also refers to the lifting system itself

locomotive – special rail car powered by diesel or electricity and used to push or pull other train cars on a track; also known as an engine

probe – device used to pull a sample of grain out of a load being carried by a truck or wagon so that it may be inspected and tested

soybeans – name used for the round, tan seeds of the soybean plant; harvested soybeans are sometimes referred to as grain but they are technically oilseeds and not a grain like corn or wheat

train car – a vehicle with wheels designed to run on a track with connectors on the front and back which allow it to be linked to other train cars

truck scale – a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed; monitored by a person known as a scale operator

Bonus terms

aeration – the process of circulating air within stored grain to keep it from spoiling

foreign material – refers to objects such as weed seeds, stones, insects, or plant parts which may be found in a sample of harvested grain; also known as F.M.

LP gas – stands for liquid propane, a type of fuel used to dry grain, heat buildings, or power stoves



How to Store Billions of Beans Information Sheet

What would you do with a billion beans? If you were a farmer who raised **soybeans**, you would have to know what to do with them when you harvested them in the fall. In fact, you would need to know where they were going *before* you harvested all those beans. Where would you put them all?

Soybeans and other crops like field corn and wheat are stored in huge **bins** or buildings until they are transported by river, rail, or road to processing plants or even other countries. Many farmers have grain bins on their farms to store their own grain until they sell it. Others take their soybeans directly to a **grain elevator**. Either way, there has to be a way to get the soybeans out of the trucks or wagons and into storage.

Grain is usually hauled off the farm by special semi trucks. The trailer of a grain truck is loaded from above by combines or grain carts which use an auger arm to move the grain from the machine to the truck. Once the truck is full, it travels to a grain elevator. Grain elevators are usually located near highways, railways, or rivers so that the stored grain can be moved easily to market.

When a truck arrives at an elevator, two important things must happen before the grain is unloaded. First, it must be determined how much grain is on the truck. Second, the grain must be tested for moisture content and quality. Both of these happen at the same time.

At the elevator, the truck must be driven first onto a huge **truck scale**. The scale weighs the entire truck, grain and all. The amount of grain in the truck is determined by subtracting the weight of the truck if it were empty from the total weight shown on the scale. One **bushel** of soybeans weighs 60 pounds so the total amount of grain on a truck would be calculated as follows:

$$\text{Total weight} - \text{weight of truck} = \text{weight of soybeans} \div 60 \text{ lbs.} = \text{number of bushels}$$

While the truck is on the scale, a **probe** is inserted into the load of grain. The probe sucks a sample into an office where a person tests the grain for moisture content and grain quality. The moisture content or wetness is measured as a percentage. Soybeans are usually harvested around 13% moisture and do not need to be dried using the elevator facility's **grain dryer**, which is fueled by **LP gas** or natural gas and is generally used to dry corn. Quality refers to whether the beans are whole, clean, of normal shape and size, and whether they contain any **foreign material**, or F.M. Foreign material could be weed seeds, small stones, insects or plant parts. Grain quality will determine how much the farmer will be paid.



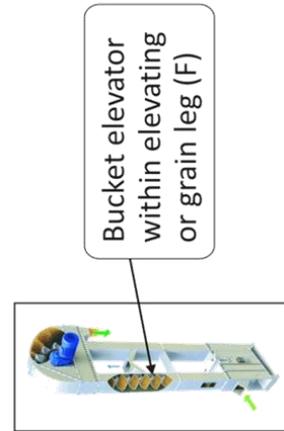
After the load is weighed and the grain tested, the truck is moved to a **dump pit**. A dump pit is an underground area covered by a heavy steel grate. The truck is positioned over the grate and then the hopper bottom of the trailer is opened so that the soybeans pour out of the truck and through the holes in the steel grate into the pit below. Dump pits at commercial grain elevators usually are sheltered by a steel building into which trucks drive before unloading.

As soybeans are being unloaded into the pit, a conveyor moves the grain to the bucket elevator. The bucket elevator is located within a steel structure often called an **elevating leg** or grain leg. It works somewhat like an elevator for people in that grain gets on at the bottom and is lifted to where it needs to go. However, instead of one elevator car, a bucket elevator is a continuous series of connected rectangular containers which, one after another, scoop grain up and lift it to the top of the elevator. Also, unlike a people elevator, the “cars” or buckets in a bucket elevator travel back down the grain leg upside down! Computerized controls within the grain facility’s **control room** determine into which bin the elevated grain will be dumped.

Once the soybeans have been stored in the proper grain bin, they will be periodically aerated to keep them from spoiling. **Aeration** involves circulating air through the grain using fans which force air into the base of the bin.

Once the stored soybeans are sold, they will be emptied from their storage bin and loaded onto **train cars** pulled by **locomotives**, river barges pushed by towboats, or trucks to be transported either to a processing facility or overseas to another country.

Grain Storage: Bushels of Beans & Corn



- A - bin
- B - truck scale
- C - probe
- D - grain dryer
- E - dump pits
- F - elevating leg
- G - train cars
- H - locomotive



How to Store a Billion Beans Vocabulary Matching Cards

Directions: Cut cards apart. Distribute terms and definitions randomly to students. Students must circulate among the class until they find the card that matches theirs.

<p>bin</p>	<p>large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin</p>
<p>bushel</p>	<p>unit of weight used to measure grain or any dry material</p>
<p>control room</p>	<p>where computerized controls at an elevator are located; manages where grain is stored, operation of the grain dryer, and the condition of the stored grain</p>



Vocabulary Matching Cards, continued

<p>dump pit</p>	<p>large underground area at a grain elevator into which grain is dumped to then be lifted into the bins or buildings for storage</p>
<p>elevating leg</p>	<p>vertical steel structure containing a series of connected rectangular buckets which scoop grain from an underground pit and lift it up to be dumped into pipes leading to storage bins; also known as a grain leg</p>
<p>grain dryer</p>	<p>huge machine used to dry grain crops before storage to prevent the grain from spoiling</p>



Vocabulary Matching Cards, continued

<p>grain elevator</p>	<p>a grain storage facility which uses a system of connected buckets to scoop grain from underground pits and lift or elevate it up to be dumped into the correct building or bin; also refers to the lifting system itself</p>
<p>locomotive</p>	<p>special rail car powered by diesel or electricity and used to push or pull other train cars on a track; also known as an engine</p>
<p>probe</p>	<p>device used to pull a sample of grain out of a load being carried by a truck or wagon so that it may be inspected and tested</p>



Vocabulary Matching Cards, continued

<p>soybeans</p>	<p>name used for the round, tan seeds of the soybean plant; harvested soybeans are sometimes referred to as grain but they are technically oilseeds and not a grain like corn or wheat</p>
<p>train car</p>	<p>a vehicle with wheels designed to run on a track with connectors on the front and back which allow it to be linked to other train cars</p>
<p>truck scale</p>	<p>a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed; monitored by a person known as a scale operator</p>



Vocabulary Matching Cards, continued

<p>aeration (bonus term)</p>	<p>(bonus term) the process of circulating air within stored grain to keep it from spoiling</p>
<p>foreign material (bonus term)</p>	<p>(bonus term) refers to objects such as weed seeds, stones, insects, or plant parts which may be found in a sample of harvested grain; also known as F.M.</p>
<p>LP gas (bonus term)</p>	<p>(bonus term) stands for liquid propane, a type of fuel used to dry grain, heat buildings, or power stoves</p>



Show What You Know about Grain Storage

Directions: Use words from the Word Bank to fill in the blanks in the paragraph below.

Harvested soybeans are stored in huge _____ or buildings. Many farmers store their crop on the farm while others use trucks to take their grain to a _____ . These facilities are usually located near highways, railways, or rivers. This allows stored grain to be moved easily to market.

At the grain elevator, the truck must drive onto a huge _____ to be weighed so the amount of grain, or number of _____ in the truck may be determined. While this is happening, the moisture and quality of the soybeans is checked using a _____ , which sucks a sample of grain out of the truck and into an office to be tested. Soybeans usually dry down enough in the fields prior to harvest, so they do not contain enough moisture for the facility's _____ to be used as it is for field corn.

After the load is weighed and tested, the truck will move to a _____ . This underground area is covered by a heavy steel grate and sheltered by a steel building. The truck is positioned over the grate and the bottom of the trailer opened. This allows the soybeans to pour into the pit below.

Once the soybeans are in the pit, they are moved up and into the grain bins with a bucket elevator. The bucket elevator is located within a steel structure called an _____ . It works a bit like an elevator in a building, but instead of lifting people, it lifts corn in rectangular buckets. At the top of the structure, the buckets dump their grain into steel pipes leading to the grain bins below. Computers in the grain elevator's _____ direct the grain to the correct bin.



When the stored soybeans are sold, they are emptied from the storage bin into _____ pulled by _____ _____, river barges pushed by towboats, or trucks, depending on the location of the elevator. The soybeans are then transported to a processing facility or even to another country.

Bonus terms

1. A person who is checking grain samples for quality will look for _____ such as weed seeds, small stones, insects, or plant parts.
2. Grain dryers can be fueled by _____ or natural gas.
3. Grain that is stored in bins must be kept from spoiling, so large fans at the base of each bin force air through the stored crop. This is called _____.

Word Bank

bins	elevating leg	probe	<u>Bonus Terms</u>
bushel	grain dryer	soybeans	aeration
control room	grain elevator	train car	foreign material
dump pit	locomotives	truck scale	LP gas