

A Field of Beans

Objective

Students will learn the name and location of the origins of various legumes. Students will conduct scientific experiments with legumes. Students will use beans to solve various math equations. Students will learn about figurative language using expressions related to beans.

Background

Peas, beans and lentils are known as pulses and also as legumes. They are the seeds of plants belonging to the family Leguminosae, which gets its name from the characteristic pod, or legume, that protects the seeds while they are forming and ripening. With approximately 13,000 species, the family Leguminosae is the second largest in the plant kingdom.

Legumes provide us with food, medicines, oils, chemicals, timber, dyes and ornamental garden plants. Everywhere in the world people depend on legumes for food—and have for thousands of years.

All legumes grow in pods. That's where the word "legume" came from. Legume is the name for the pod covering the peas or beans. It splits into two valves with the seeds attached to the lower edge of one of the valves.

The Greeks and Romans used the broad bean for balloting. Black beans signified opposition, and white beans signified agreement. This custom carried over into England in the election of the king and queen for Twelfth Night and other celebrations and was taken to the New World colony at Massachusetts Bay, where Indian beans were used.

In Oklahoma we grow several varieties of legumes—some in our gardens, some in our fields, some to feed our animals and some to feed ourselves. Farmed legumes fall into two classes: forage and grain. Forage legumes, like alfalfa, clover and vetch, are sown in pasture and grazed by livestock. Grain legumes are cultivated for their seeds and are also called "pulses." The seeds are used for humans and animals to eat, for producing oils or for other industrial uses. Grain legumes include beans, lentils, lupins, peas and peanuts.

BLACK-EYED PEAS are a minor commodity in Oklahoma. Also called cowpea or southern peas, they have been Oklahoma's number one vegetable crop for several years. GARDEN PEAS are usually the first vegetable to be planted in home gardens, very early in the spring or late in the winter.

Oklahoma C3 Standards

GRADE 1

Science Process—1.1,2; 2.1; 3.1,2; 4.1

Life Science—2.1,2

Social Studies PALS—1.A.1,2; 3.A.2,
B.4

Social Studies Content—3.2,3; 4.3

Physical Education—2.5; 3.3; 4.4

COMMON CORE

Math Process—MP.1,2,4,5,7

Math Content—1.OA.1,2,3,4,5,6,7;
1.MD.4; 1.G.1,2,3

Language Arts—1.RFS.2; 1.L.2.e,5

GRADE 2

Science Process—1.1,2; 2.1; 3.1,2; 4.3

Life Science—2.1

Social Studies PALS—1.A.1,2; 3.A.2,
B.4

Social Studies Content—3.1; 4.2,4

Physical Education—2.13; 3.5

COMMON CORE

Math Process—MP.1,2,4,5,7

Math Content—2.OA.1,3,4; 2.NBT.2;
2.MD.10; 2.G.3

Language Arts—2.RL.2; 2.RFS.4abc;
2.L.4a,5

GRADE 3

Science Process—1.1,2; 2.1; 3.1,2; 4.3

Life Science—2.1,2

Social Studies PALS—1.A.1,2; 3.A.2,
B.4

Social Studies Content—2.3; 3.1e,2ab

Physical Education—2.1

COMMON CORE

Math Process—MP.1,2,4,5,7

Math Content—3.OA.1,2,3,5,7,9;
3.MD.3; 3.G.2

Language Arts—3.RL.3; 3.RIT.2;
3.RFS.3c,4c; 3.L.4.a, 5a, 6

GRADE 4

Science Process—1.1,2; 2.1; 3.3

Life Science—3.1,2

Social Studies PALS—1.A.1, 2; 3.A.2,
B.4

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Social Studies Content—1.3, 4

Physical Education—1.5

COMMON CORE

Math Process—MP.1,2,4,5,7

Math Content—4.OA.1,2,5; 4.G.3

Language Arts—4.SL.1b, 4; 4.L.5a

GRADE 5

Science Process—1.1,2; 2.1; 3.3

Life Science—2.1

Social Studies PALS—1.A.1,2; 3.A.2

Social Studies Content—2.5

Physical Education—3.1

COMMON CORE

Math Process—MP.1,2,4,5,7

Math Content—5.NFS.4b

Language Arts—5.L.4c, 5a

Why do beans give you gas?

Beans have complex sugars in them that can't be digested by human digestive enzymes. These sugars sail untouched through the upper intestine, only to be met in the lower intestine by hungry bacteria. The bacteria eat the sugar, and they give off gas.

As with many vegetables, the more beans you eat, the more your body will become adapted to them. Dietitians recommend introducing these foods to your diet a little at a time to give your body a chance to get used to them. You can also reduce gas by soaking and rinsing dry beans before cooking them.

Fresh beans produce less gas.

Beans contain a higher percentage of protein than most other plant foods, but they need whole grains to make them complete.

Whole grains contribute different amino acids than beans, but in combination they make complete proteins. Ancient people must have known this, since they always grew whole grains like wheat along with their

legumes. The US Food and Drug Administration recommends that we include plenty of whole grains and legumes in our diets.

GREEN BEANS are also called snap beans because of the snapping noise they make when you snap off the ends.

Green beans are available fresh, canned and frozen.

LIMA BEANS are sometimes available fresh from farmer's markets. Most lima beans are sold dried, canned, or frozen.

MUNG BEANS are another minor commodity in Oklahoma. They are grown mostly for livestock feed in Oklahoma, but they are also the bean most commonly used for making bean sprouts.

SOYBEANS are considered the world's most important legume because of their nutritional value. In the US they are produced more for feeding animals than for human consumption.

PEANUTS were called ground nuts by the people in South America who were eating them 4,000 years ago.

Social Studies

1. Divide the room into continents (excluding Antarctica). Divide the class into teams, and provide each team with a world map or globe. As you read out the legume fact, one student from each team will move to the part of the room representing the continent where the legume **originated**.
 - Cowpea is another name for black-eyed-peas or southern peas. They **originated** in Ethiopia, but have been cultivated since ancient times in China. (Africa)
 - The lima bean is named after the capital city of Peru—the country where it **originated**. Lima beans are also called “butter beans.” (South America)
 - Snap beans **originated** in southern Mexico (North America), Guatemala (Central America), Honduras (Central America), and Costa Rica (Central America). They grew on vines and were planted with corn, which served as a prop for the vines.
 - Lentils, peas, chick-peas and fava beans were brought into cultivation by Neolithic people in the Fertile Crescent of the Near and Middle East (present-day Syria, Iran, Iraq, Turkey, Jordan, Israel). (Asia)
 - Australian aborigines ground the seeds of the wattle plant between stones to form a flour which was then baked.(Australia)
2. Provide a sample of each of the legumes named above, and have students glue them to a world map. For those legumes for which a sample is not available, use a rep-

resentation. (Australian wattles are in the acacia family, the same family as mimosa.)

Language Arts

1. Provide the vocabulary list to students. Write each word on a bean-shaped piece of paper, and have students draw them from a “bean pot.” See how quickly each student can draw a picture conveying the word meaning without using words.
2. Provide copies of the story “Janet and the Beanstalk,” included with this lesson. For each word underlined in the story, students will name the part of speech and replace it with a different word to create a different story.
 - Students will work in groups and act out their stories.
 - Students will read the original Jack and the Beanstalk story and discuss how it reflects a culture different from their own.
 - Students will change the story to reflect what they know of another culture.
3. Hand out the worksheet “Using the Old Bean,” included with this lesson.
 - Students will complete complete the worksheet to learn about figurative language and rhyming words.

Science

1. Beans are strong growers. Try this experiment to see just how strong.
 - Mix plaster of Paris with water.
 - Pour into a styrofoam cup.
 - Place a dry lima bean in the middle of the mixture.
 - When the plaster of Paris is dry, peel the cup from around it.
 - Set it on a table and watch what happens. (The lima bean should swell from the moisture in the plaster of Paris and crack the plaster.)
2. Which of these Oklahoma vegetables are legumes? (Remember, legumes grow in pods.)

green beans	lettuce
squash	garden peas
black-eyed peas	okra
spinach	pinto beans
tomatoes	lima beans
potatoes	broccoli

(Answers: green beans, garden peas blackeyed peas, pinto beans, lima beans)
3. Many whole beans and peas (e.g. aduki, chickpeas, whole lentils, marrowfat peas, mung and soybeans) can be sprouted to increase their nutritional value. Sprouts are a good source of protein and Vitamin C.

The Nitrogen Cycle

Farmers appreciate legumes because they fix nitrogen in the soil. This reduces fertilizer costs and means that legumes can be used in a crop rotation to replenish soil that has been depleted of nitrogen.

Air is about 78% nitrogen, making it the largest pool of nitrogen. Nitrogen is essential for many biological processes. In plants, much of the nitrogen is used in chlorophyll molecules essential for photosynthesis and further growth.

Fixation converts gaseous nitrogen into forms usable by living organisms. Some fixation occurs in lightning strikes, but most fixation is done by free-living or symbiotic bacteria. These bacteria have the enzyme that combines gaseous nitrogen with hydrogen to produce ammonia, which is then further converted by the bacteria to make its own organic compounds. Some nitrogen-fixing bacteria, such as rhizobia, live in the root nodules of legumes (such as peas or beans). Here they form a symbiotic relationship with the plant, producing ammonia in exchange for carbohydrates.

Vocabulary

ammonia—a colorless gas that is a compound of nitrogen and hydrogen

bacteria—single-celled microorganisms that live in soil, water, the bodies of plants and animals, or matter obtained from living things and are important because of their chemical effects and disease-causing abilities

chlorophyll—the green coloring matter of plants that is found in chloroplasts and is necessary for photosynthesis

enzyme—any of various complex proteins produced by living cells that bring about or speed up reactions (as in the digestion of food) without being permanently altered

flatulence—the presence of too much gas or air in the stomach or intestine, passed out of the body

forage—food (as pasture) for browsing or grazing animals

grain—the threshed seed or fruits of various food plants

hydrogen—a chemical element that is the simplest and lightest of all chemical elements and is normally found alone as a colorless, odorless highly flammable gas having two atoms per molecule

indigenous—produced, growing, or living naturally in a particular region or environment

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- Measure one cup of chickpeas, whole lentils or mung beans in a container, and measure two cups of water to cover.
 - Students will predict what will happen and record their predictions.
 - Next day students will look at the beans and discuss their observations.
 - Students will carefully remove the beans with a slotted spoon and measure them again.
 - Students will measure the water that remains.
 - Rinse the beans and return them to the container.
 - Rinse daily and keep the beans moist until they begin to sprout.
 - Students will draw pictures of the beans each day to record their progress.
 - After beans have sprouted, place them near a sunny window for one day, just until they are green.
 - Discuss observations.
 - Enjoy your nutritious sprouts on a salad or in stir fry.
4. Dry beans are produced in pods and belong to the family of plants called “legumes.” The shape of the bean distinguishes it from other legumes like peas and lentils. Usually beans are kidney-shaped or oval, while peas are round, and lentils possess a flat, disk-like shape.
- Students will sort a mixture of dried beans according to shape to determine if they are peas (round) or beans (kidney-shaped).

Math

1. Bring fresh green garden peas or green beans to class for students to examine and shell.
 - Students will estimate the number of peas in the pods before shelling them.
2. Bring assorted dried beans and peas to class. Divide students into groups and have groups sit in circles on the floor. Pour a bag of mixed beans on the floor in the center of each group.
 - Provide copies of the Bean Sorting Map included with this lesson. Students will sort the beans using the steps shown on the map.
 - Students will count the number of beans of each kind and use appropriate graphs to show the number of each.
 - Groups will race to see which group can get the beans sorted quickest.
 - Students will count the beans by 2s, 5s, 10s and 100s.
 - Divide a shape into halves, thirds, fourths, etc. Students will use different beans to fill in each area.
 - Students will use the beans to show the line of symmetry for two-dimensional figures.
 - Students will use beans to represent and solve problems involving addition, subtraction, multiplication and division.
 - Students use the bean assortment to create patterns.
 - One student will count out eight beans. Place eight beans in your own hand, and hide them behind your back. While they are behind your back, put some in each hand (e.g. three in one, five in another.) Show the stu-

dent the beans you have in one hand. The student will tell you how many are in the other hand. Use different combinations and different numbers of beans.

—Take advantage of the variety of legume colors and shapes to make mosaics using geometric patterns. Students will count the beans within the shapes to find volume.

—Use small paper plates and beans to develop multiplication algorithms. (Place three beans each on four plates to show multiplication as repeated addition.)

3. In the South, people eat black-eyed peas on New Year's Day for good luck. Take a poll to find how many students eat black-eyed peas for New Year.

—Use beans to keep count. White beans mean “yes,” and black beans mean “no.”

—Keep the beans in the jar throughout the week.

—Students will add a dried black-eyed pea to the jar if they believe eating black-eyed peas really bring good luck.

—Students will estimate before counting and graph the results.

Physical Activity

1. Play the game “Beans and Peas,” as follows:

—Divide players into two equal lines, one called “Beans” and the other called “Peas.”

—Have players stand about five feet apart, facing each other, on opposite sides of a center line.

—Behind each group of players and about 25 feet away, designate a goal line.

—When the game leader calls out “Beans!” that group turns and runs toward its own goal line, with the Peas in pursuit.

—Any Bean tagged before crossing the line joins the other side. The action continues with the leader giving each side a fairly even number of chances to chase its opponents.

Extra Reading

Bean, Raymond, *Sweet Farts # 1*, BookSurge, 2008.

Bial, Raymond, *The Super Soybean*, Albert, Whitman and Company, 2007.

Braun, Eric Mark, and Cristian Bernadini, *Trust Me, Jack's Beanstalk Stinks! The Story of Jack and the Beanstalk as Told by the Giant*, Picture Window, 2011.

Cherry, Lynne, *How Groundhog's Garden Grew*, Blue Sky, 2003.

Kimmel, Eric A., and John Manders, *Jack and the Giant Barbecue*, Marshall Cavendish, 2012.

Tagliaferro, Linda, *The Life Cycle of a Bean*, Capstone, 2007.

Winner, Ramona Moreno, and Nicole Velasquez and Mary McConnell, *Lucas and His Loco Beans: A Tale of the Mexican Jumping Bean*, Brainstorm 3000, 2002.

Vocabulary (Cont.)

legume—any of a large family of herbs, shrubs, and trees that have fruits which are dry single-celled pods that split into two pieces when ripe, that bear nodules on the roots that contain nitrogen-fixing bacteria, and that include important food plants (as peas, beans, or clovers)

nitrogen—a colorless, tasteless, odorless element that occurs as a gas which makes up 78 percent of the atmosphere and that forms a part of all living tissue

nodule—a swelling on the root of a plant of the legume family that contains nitrogen-fixing bacteria

pulse—the edible seeds of several crops (as peas, beans, or lentils) of the legume family; also, a plant-yielding pulse

symbiotic—the living together in close association of two different kinds of organisms (as a fungus and an alga making up a lichen) especially when such an association is of benefit to both

valve—one of the pieces into which a ripe seed capsule or pod separates

Janet and the Beanstalk

For each word underlined below, name the part of speech.



Janet was a poor Oklahoma girl from Bigsby. One day her mother sent her to the cattle auction to sell their Hereford cow. Along the way, Janet met a man who offered to buy the cow for five "magic lima beans." Janet made the deal. Her mother was not happy. She threw the beans out the window and sent Janet to bed without dinner.

Overnight, the beans grew into a gigantic beanstalk. It reached so far into the sky that the top was completely out of sight. Janet decided to climb the beanstalk. She arrived in a land high up in the clouds, the home of a scary giant. When she broke into the giant's home, the giant quickly sensed someone was near:

"Fee! Fie! Foe! Fum! I smell the blood of an Oklahoma farm girl. Be she 'live, or be she dead, I'll grind her bones to make my bread."

Janet was saved by the giant's assistant, a former Oklahoman, and she escaped from the giant's home. On her way out, she grabbed some gold coins. Back home, Janet and her mother celebrated, but the coins did not last. Janet climbed the beanstalk again. This time she stole a hen which laid golden eggs. Again she was saved by the giant's assistant. She went down the ladder and showed the chicken to her mother, and the two lived happily on the proceeds from the hen's eggs. Eventually, Janet grew bored and decided to climb the beanstalk a third time. This time, she stole a magic guitar that sung to itself. The instrument did not appreciate being stolen and called out to the giant for help. The giant chased Janet down the

beanstalk, but luckily she got to the ground before the giant did. Janet immediately chopped it down with an axe. The giant fell to the earth, pulling the beanstalk down with him.

Read the original Jack and the Beanstalk story and discuss how it reflects a culture different from our own. Change the story to reflect what you know of another culture.

DID YOU KNOW THAT "BEANSTALK" IS ANOTHER NAME FOR THE SPACE ELEVATORS USED BY NASA IN SPACE FLIGHT?

Ag Lib: Janet and the Beanstalk

Fill in the blanks below to create a new story. Use words and parts of speech as directed in the small print under the blank. Work in groups to act out your stories.

_____ was a poor Oklahoma girl from _____. One day her mother
Name of girl Name of town
sent her to _____ to sell their _____. Along the way, she met a(n)
A Place Type of Livestock
_____ who offered to buy the animal for five "magic lima beans." The girl made the deal.
noun
Her mother was not happy. She _____ the beans out the window and sent her daughter to
verb
bed without dinner.

Overnight, the beans grew into a(n) _____ beanstalk. It reached so far into
adjective
the sky that the top was completely out of sight. The girl decided to _____ the
verb
beanstalk. She arrived in a land high up in the clouds, the home of a(n) _____ giant.
adjective
When she broke into the giant's home, the giant quickly sensed someone was near:

"Fee! Fie! Foe! Fum! I smell the blood of an Oklahoma farm girl. Be she 'live, or be she
dead, I'll grind her bones to make my bread."

The girl was saved by the giant's _____, a former Oklahoman, and she escaped
noun
from the giant's home. On her way out, she grabbed some _____. Back home, she and
noun
her mother celebrated, but the item did not last. She climbed the beanstalk again. This time she
stole a(n) _____ which laid golden eggs. Again she was saved by the giant's
type of bird
_____. She went down the ladder and showed the _____ to her mother, and
noun bird
the two lived happily on the proceeds from the bird's eggs. Eventually, the young girl grew
bored and decided to climb the beanstalk a third time. This time, she stole a magic _____
musical instrument
that sung to itself. The instrument did not appreciate being stolen and called out to the giant for
help. The giant chased the girl down the beanstalk, but luckily she got to the ground before the
giant did. She immediately chopped it down with a(n) _____. The giant fell to the
noun
earth, pulling the beanstalk down with him.

Name _____

Using the Old Bean

Match the bean expression with its meaning. Discuss.

- | | |
|---------------------------|--------------------------------------|
| full of beans | Using your intelligence |
| spill the beans | Energetic; frisky; or badly mistaken |
| bean counter | To disclose a secret |
| cool beans | Knows very little |
| doesn't know beans | Accountant |
| using the old bean | Great! |
| not worth a hill of beans | Worthless; little value |



Circle the words that rhyme with bean:

- mean main green gain jeans bang seen

Circle the words that rhyme with pea

- see pan knee we pay please me

Write a sentence using at least three of these words along with the word "bean" or "pea."



Name _____

Using the Old Bean (answers)

Match the bean expression with its meaning. Discuss.

full of beans ----- Using your intelligence

spill the beans ----- Energetic; frisky; or badly mistaken

bean counter ----- To disclose a secret

cool beans ----- Knows very little

doesn't know beans ----- Accountant

using the old bean ----- Great!

not worth a hill of beans ----- Worthless; little value



Circle the words that rhyme with bean:

mean main green gain jeans bang seen

Circle the words that rhyme with pea

see pan knee we pay please me

Write a sentence using at least three of these words along with the word "bean" or "pea."



