

# Soybeans All Around Us

## Objective

Students will learn the many uses for soybeans. Students will read food labels to identify foods made with soybeans. Students will research to identify additional uses for soybeans.

## Background

The soybean comes from a crop grown in Oklahoma fields. Soybeans were probably first domesticated by farmers in Northern China during the 11th century. They came to the US around 1765 when Benjamin Franklin sent them here from England.

A soybean pod usually contains 2-4 seeds, and the whole soybean plant can contain 20-30 pods. Soybeans are in the legume (pronounced LEG yoom) family. Peas, beans and peanuts are also legumes. The fruit of legumes grows in pods. Like all legumes, Soybeans put nutrients back into the soil as they grow. That makes it beneficial for farmers to plant soybeans in a process called “crop rotation,” meaning the same plants are not planted in the same field every year. This process makes crops healthier and is better for the soil.

Soybeans are planted in the spring and harvested in the fall. However, farmers must work the entire year to ensure a good crop. During the winter, before the seeds can be planted, the farmer must make sure all his or her machinery is in proper working condition. This is also the time of year when the soybean producer purchases the seeds that will be used in the spring.

In spring the farmer will prepare the soil and plant the soybeans. While the soybeans are growing throughout the summer, the farmer must control weeds and insects and irrigate the crop when there is no rain.

Harvest time comes in the fall. From planting to harvest is 14-16 weeks. The farmer can tell when it is the right time to harvest the crop because the soybean plants will stop growing and become dry. The leaves will turn yellow and drop to the ground, and the pods will turn a golden tan.

Farmers use a very large piece of machinery called a “combine” to harvest the crops. The combine can do many jobs at once. It cuts the soybean plants, then separates the beans from the pods and cleans them.

Soybean crop yields are measured in bushels. All US bushels contain eight gallons, but different crops weigh different amounts. A bushel of soybeans weighs 60 pounds.

After harvest, soybeans are processed. Soy processors take the raw soybeans and separate them into two parts, the oil and the meal. Soy meal is very high in protein and is most often sold for animal feed. It can also be used for some human consumption in products such as soy flour.

The oil that is extracted from the raw soybean is used to make many products for human consumption—both food and nonfood. Soybeans accounts for 80 percent or more of the edible fats and oils consumed in the US. The oil in soybeans is considered an excellent emulsifier, meaning it can

## Oklahoma Academic Standards

### GRADE 2

English Language Arts—  
1.R.1,2,3,4; 3.R.5; 4.R.1,5;  
1.W.1,2; 2.W.1,4; 3.W.2  
Science—PS1.1,2,3  
Math—N.1.1; 2.1,2,3,5;  
GM.2.1,2

### GRADE 3

English Language Arts—  
1.R.1,2,3,4; 4.R.1,5; 1.W.1,2;  
2.W.1,4; 3.W.2  
Science—LS1.1  
Math—N.1.1; 2.1,2,3,5,8;  
3.2,3,4; GM.2.7,8

### GRADE 4

English Language Arts—  
1.R.1,2,3,4; 4.R.1,5; 1.W.1,2;  
2.W.1,4; 3.W.2  
Math—4.N.1,3,4,5; 2.3,4

## Vocabulary

**biodegradable**— capable of being broken down especially into harmless products by the action of living things (as bacteria)

**biofuel**—fuel produced from renewable resources, especially plant biomass, vegetable oils, and treated municipal and industrial wastes

**bushel**— unit of volume in the US Customary System, used in dry measure

**combine**—power-operated harvesting machine that cuts, threshes, and cleans grain

**crop rotation**—the successive planting of different crops on the same land to improve soil fertility and help control insects and diseases

**emulsifier**—an agent that forms or preserves as a food additive and prevents separation of sauces or other processed foods

**expense**— something spent or required to be spent, cost

**extracted**—removed by pressing, distilling, or by a chemical process

**fertilizer**—any substance, such as manure or a mixture of nitrates, added to soil or water to increase its productivity

**gross revenue**— total earnings before any deductions

**harvest**—the act or process of gathering a crop

**irrigation**—the act of supplying land with water by means of ditches, pipes, or streams; to water artificially

**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)

**net revenue**—earnings after all charges or deductions

**processed**— changed or prepared by special treatment

**soybean**—a hairy annual Asian plant of the legume family widely grown for its edible seeds rich in oil and proteins, as food for livestock, and for soil improvement

**yield**— the amount or quantity produced or returned, as a high yield of wheat per acre

make water and fats compatible. Soybean oil is also used in the manufacture of biofuel, ink and paint, and fibers for clothing and yarn.

## English Language Arts

1. Read and discuss background and vocabulary
  - Bring raw soybeans to class for students to see and feel. (Sometimes available from health food stores or the health food section of the grocery store.)
  - Ask students to list products they can think of that might be made from soybeans.
2. Students will work in groups to write and perform short commercials for soy products, using a variety of media products to enhance their presentation (i.e. power point, Prezi, poster board).
3. Introduce several different packaged food products to the class. (chocolate bar, potato chips, package of bread, crackers, etc.)
  - Students will list the ingredients they think might be used to make the products.
  - Students will take turns reading the labels to find soy-based ingredients (soy lecithin, soy oil, etc.)
4. As a homework assignment, students will look at home to find food items in which soy or soybean oil is listed as an ingredient.
  - Students will report back to the class.

## Science/Math

1. Ask students to define the word “biodegradable.” Write definitions on the board and provide a dictionary definition to verify.
  - Discuss the difference between biodegradable products and products that are not biodegradable. Explain that products made from soybeans and other plant-based materials are biodegradable because they break down over time, while petroleum products are not biodegradable because they do not break down over time.
  - Discuss the advantages of using products that are biodegradable.
2. Assign students to groups of three or four. For each group provide samples of the following products made from soybeans—ink, crayons, candles—and samples of the same products made from petroleum.
  - Students will work in their groups to design charts to compare soy- vs. petroleum-based products
  - Students will handle the products in their groups and

write words to describe the products on their charts.

—Students will use Venn diagrams to compare the soy-based vs. petroleum-based items.

—Students will discuss their observations with the class.

—Students will write short papers in which they discuss the benefits of using soy vs. petroleum-based products

3. Students will work in groups to make biodegradable plastic, as follows:

—Place 1 tablespoon cornstarch, 1 teaspoon soybean oil and 1 tablespoon water in a plastic bag.

—Close the bag and knead it to mix the contents.

—Add 2 drops of food coloring and knead again.

—Seal the bag, leaving one corner slightly open to vent the contents.

—Heat the bag in a microwave for 20-25 seconds on high. **WARNING: THE BAG WILL BE VERY HOT WHEN YOU REMOVE IT FROM THE MICROWAVE. REMOVE CAREFULLY.**

—Lead a class discussion based on the following questions:

- What are some words that describe the substance you have made?
- What are some possible uses for what you have created?
- Why is this plastic considered biodegradable?
- What are some products currently on the market that soy plastic could replace?

## Math

Note: If raw soybeans are not available, use any dry bean readily available.

1. Students will cut 1-inch squares from paper to represent one acre in a field.

—Students will use masking tape to lay out “fields” on the floor or on their desks. Inform students that fields are very rarely perfectly square, so their “fields” may take any shape.

—Students will use the square units they have cut to determine the number of acres in their fields.

—Provide each student with a cup of dried beans.

—Students will count the total number of beans.

—Students will estimate and record how many beans each acre of their field produced if the beans are distributed equally across the field.

—Students will distribute the beans equally among the acres on their fields.

—Students will determine how many beans each acre produced?

—Students will develop multiplication and division problems to describe the number of beans produced on their fields.

2. Divide the classroom into four separate quadrants, or acres to represent a field.

—Ask students how many parts of the “field” make half. How many make  $\frac{3}{4}$ ?

—Explain that crop yields are measured in bushels.

—Students will pretend they are the bushels of soybeans and distribute

## Materials

raw soybeans (available in health food stores or health food sections of grocery stores or feed and seed stores)

assorted products made from soybeans and soybean oil

cornstarch

soybean oil

water

sandwich size resealable plastic bags

food coloring

masking tape

paper

soybeans or any dried beans

## Ag Career: Soil Conservationist

A soil conservationist helps landowners manage the use of their land. Their primary focus is soil erosion. Generally, soil conservationists study the effects of land use and develop new practices to sustain or restore the land. They can also create conservation guidelines. Farmers, ranchers, mining companies and all levels of government employ soil conservationists to perform environmental surveys and advise on land management strategies. They may oversee the construction of terraces to prevent erosion on slopes. They may also recommend that a farmer grow certain crops or develop a crop rotation plan.

Many different degree programs can qualify students for work as a soil conservationist, including agricultural science, environmental studies, range management, agronomy and hydrology. Relevant coursework includes mathematics, geology, ecology, data analysis, soil fertility and soil science.

Aside from degree requirements, soil conservationists should be able to relate well with people in the agricultural industry and other scientists. Speaking, writing and listening skills are a must for any professional position. Soil conservationists are often called upon for their professional standpoint on certain legal and ethical matters concerning the preservation of land.

Source: Education Portal at [http://education-portal.com/articles/Soil\\_Conservationist\\_Job\\_Description\\_Duties\\_and\\_Requirements.html](http://education-portal.com/articles/Soil_Conservationist_Job_Description_Duties_and_Requirements.html)

themselves as equally as possible throughout the four acres of the field/classroom.

—How many bushels did each acre produce? Did all four acres produce an equal number? Why or why not? Explain that on a real field of soybeans, not all the acres produce the exact same number of bushels.

—Tell students that a bushel of soybeans weighs 60 pounds. Based on that figure, students will develop and solve number sentences to determine the total weight of the soybeans in their acre. What is the total weight for the entire field?

3. Provide copies of the Revenue Worksheet included with this lesson. Discuss the terms “revenue,” “expenses,” “gross revenue” and “net revenue.”  
—Students will use appropriate math operations to complete the worksheet

### Extra Reading

Anderson, Susan & Buggey, JoAnne, *Soybeans in the Story of Agriculture (Awesome Agriculture for Kids)*, Northwest Arm, 2009.

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

Conley, Shawn, and Judy Mannes, and Marsha Rehns, *COOLBEAN, The Soybean*, American Society of Agronomy, Crop Science Society of America and Soil Science Society of America, 2013.

Hemple, Linda K., *Have Fries—Will Travel!: The Adventures of a Veggie Powered Car and an Eco-Rap*, New Society Publishers, 2005.

Lo, Ginnie, *Auntie Yang's Great Soybean Picnic*, Lee & Low, 2012.

Name \_\_\_\_\_

# Revenue Worksheet

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## REVENUES (PER ACRE)

Average Crop Yield per acre ..... 56 bushels

Price received per bushel..... \$12.50

GROSS REVENUE..... \_\_\_\_\_

## EXPENSES (PER ACRE)

Land.....\$359

Fertilizers .....50

Pesticides .....29

Seed .....55

Drying..... 1

Storage.....2

Crop insurance .....32

Machine hire ..... 16

Utilities.....4

Fuel and oil.....20

Machine repair.....19

Hired labor ..... 11

Building repair and rent .....6

TOTAL COSTS PER ACRE ..... \_\_\_\_\_

NET RETURN PER ACRE..... \_\_\_\_\_