



Soy, the Super Bean

OVERVIEW: This lesson will show students how the abundant protein of soybeans is included in our diets as well as the myriad of other ways soybeans are used in our daily lives. It introduces legumes and their ability to enrich soil with nitrogen. And there's also a quick trip through the history of soybeans – including Henry Ford's soybean car!

GRADES: 3-5

OBJECTIVES: The student will be able to:

- Name a number of food and non-food products that soybeans are used to make.
- Explain how soybeans can replace nitrogen in the soil.
- Explain the meaning of *crop rotation*.



MATERIALS:

The *New Jersey Agriculture in the Classroom* powerpoint presentation *Soy, The Super Bean*, available to download under Teaching Resources, NJ Ag in a Box Lessons, at newjersey.agclassroom.org.

Soy the Super Bean question worksheet for each student

A soy-based crayon (such as Prang brand) and a paraffin wax crayon (such as Crayola brand) for each student

Compare Crayons worksheet for each student

Soy Scavenger Hunt homework worksheet for each student

Optional: soybeans, planting pot with drainage holes (you can use any container, such as a yogurt container, and punch holes in the bottom), soil from outside

Extensions: Make ink and/or lip balm from soy. See the material list on the instructions below.

VOCABULARY

renewable resource: a natural material that can be replenished. This means they come back or can be easily replaced after we use them. Plants, wind, and sunlight are all renewable resources.

non-renewable resource: a natural material from the Earth that exists in limited supply and cannot be replaced quickly once it is used up. Fossil fuels like coal, oil, and natural gas are non-renewable resources.

legume: plants such as beans, peas, lentils and peanuts, that can partner with bacteria to transform nitrogen in the air, into nitrogen in the soil that plants can use. This is called “fixing” nitrogen.

nodule: a lump that forms on the soybeans roots that contain the rhizobia bacteria that aid in nitrogen fixing.

crop rotation: farmers plant different crops in the same area over several growing seasons to keep the soil healthy. Different crops need different nutrients from the soil. Some crops, like corn, take a lot of nitrogen. Others, like beans, can put nitrogen back into the soil.

PROCEDURE:

Give each student a *Soy the Super Bean* question worksheet. Ask students if they know what soy is and what it is used for. Write a list of their answers.

Tell students they are going to see a slide show about soybeans. Ask them to listen for the answers to the questions on the *Soy the Super Bean* worksheet and write down their answers or notes they can use for answers afterward. After the slide show, give the students a few minutes to complete their worksheet.

Discuss the powerpoint presentation and the answers to the worksheet. Ask students for examples of different renewable and non-renewable resources. Write and display a list.

Compare crayons made from soy and from paraffin wax

Tell students they are going to compare crayons made from soy and crayons made from paraffin wax. Explain that paraffin wax is made from oil, coal, or shale oil, which are non-renewable resources. It takes millions of years for these resources to form underground. Soy is a renewable resource, because farmers can always plant another crop.

Ask students to complete the *Compare Crayons* worksheet.

When finished, count how many students liked the paraffin wax or the soy crayons better. Discuss the reasons and talk about which is better for the environment.

Soy Scavenger Hunt Homework

For homework, ask students to go on a soy scavenger hunt at home, looking for food and non-food products that contain soy. Demonstrate how to find the ingredients on containers.

The next day, make a class list of all the products found.

EXTENSION: Planting Soybeans

Give your students the opportunity to plant some soybeans to see if the roots grow nodules, indicating the presence of bacteria that can help enrich the soil with nitrogen.

You will need soybeans and containers that are about 4 inches in diameter with drainage holes in the bottom. The students should fill the containers with soil from outside the school where some plants are growing. *Do not use commercial potting soil and do not pick an area where the plants have been fertilized.* You want to try to pick an area of soil that might be low in nitrogen.

The soybean seeds should be planted 1 inch deep. The soil should be kept moist but not soaking wet.

Ask your students to observe and write a description weekly about the changes they see as the soybean sprouts and grows. They should let their plants grow for about 4-5 weeks.

Next, the students should carefully remove the soybean plants from the pots and gently wash the soil off the roots. Using a magnifying glass, they should inspect the roots for small, round growths. These are the nodules. Inside these nodules, bacteria are turning nitrogen from the air into nitrogen in the soil for the plant. If you squeeze the nodules, they might be pink inside, which means they are actively fixing nitrogen.

No nodules? It is possible that students will not observe nodules. This could mean the soil the soybeans were planted in did not contain the specific rhizobia bacteria needed to form nodules and fix nitrogen. Or it could mean that the soil was nitrogen-rich and the plant did not need additional nitrogen. If you don't find nodules, your students can always try the experiment again with soil from a different area.

EVALUATION:

Completed *Soy the Super Bean*, *Compare Crayons* and *Soy Scavenger Hunt* worksheets.

EXTENSION

Connect the use of biodegradable plastics and other renewable resources to the efforts to combat climate change by teaching the NJAITC lesson *The Greenhouse Effect*, available to download under Teaching Resources, Climate Change, at newjersey.agclassroom.org.

New Jersey Learning Standards

Science: K: LS1.C 1: LS1.A 2:LS2.A 3:LS1.B 4:LS1.A 5:LS2.A

Social Studies Grades 3-5: 3-3-5.1.5.EconGE.2 5:6.1.5.GeoHE.2,
6.1.5.EconEM.1, 2 6.1.5.EconNE.4

English Language Arts: 3:W.3.2.A-D 4:W.4.2.A-E 5: W.5.2.A-E

Climate Change 3-5: 4-ESSC-1 4-ESSC3-2 5-LS2-1

Name_____

Soy the Super Bean

Listen for the answers to these questions in the slide presentation:

Name some of the foods that soy is used in:

Name some of the non-food products that soy is used in:

What is a renewable resource?

What can soy and other legumes do for the soil that no other plants can do?

What is crop rotation?

Name _____

Compare Crayons: Which Do You Like Better?

In the space below, draw two pictures: one with a crayon made of soy and one with a crayon made of paraffin wax.

(Please answer in complete sentences.)

Which crayon did you like using better? Explain your answer.

Which crayon do you think is better for the environment and why?

How to Make Soy Ink

Printing ink was originally made from petroleum oil, which must be pumped from far underground. Then about 45 years ago, newspaper companies began to experiment with using a renewable resource, and it was discovered that soy made a good base for ink. Not only was it renewable, it provided brighter colors and made recycling easier because the ink was easier to remove.

MATERIALS

Note: Teacher will divide the class into small groups and each group will make one color of ink. The materials below are for one color – multiply by the number of groups you will have.

¼ cup soybean oil (often called vegetable oil)	1 tablespoon measuring spoons for each group
for each color ink you plan to make	
¼ cup water for each color	Spoons or forks for stirring
1 tablespoon soy lecithin for each color	Bowl or other container to mix each color paper
Food coloring of various colors	Q-tips, rubber stamps, or slim paint brushes
Small paper cups	
¼ cup measuring cups for each group	

PROCEDURE:

Divide students into small groups. Give each group a quarter-cup measuring cup, 1 tablespoon, a bowl, and spoons or forks for stirring. Give each group a different color food coloring. (Students may wish to make additional colors – such as orange from red and yellow) Ask students to take turns measuring and stirring.

Tell students to add ¼ cup soy oil and ¼ cup water to the bowl. Ask the groups to try to mix the water and soy together.

Note: Explain that the soy oil does not mix well with water until the lecithin is added. Soy lecithin is used for mixing fats and oils with water. Lecithin is commonly found in chocolate candy and salad dressing.

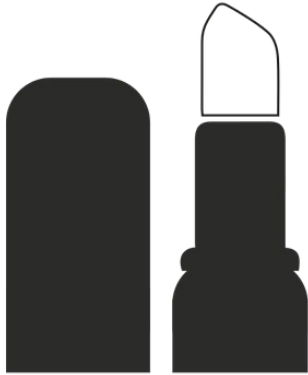
Each group adds 1 tablespoon of soy lecithin to the oil and water and stirs vigorously until any lumps are gone. Add a few drops of food coloring to the mixture and stir. (Students can experiment with adding more food coloring to reach the desired color.)

NOTE: Food coloring will stain clothing, so ask students to roll up their sleeves, wear smocks, or assist younger students.

Divide ink into small cups for use by all the groups of students. Use Q-tips or slim paint brushes to write or draw with the ink on paper, or use stamps, if available, to stamp images.

EXTENSION: Give students the opportunity to experiment with the amount of soy oil and water to see if it changes the quality of the ink.

How to Make Soybean Lip Balm



MATERIALS: *(for a class of 24)*

Small paper cups

½ cup beeswax pellets *(Read about beeswax below.)*

1 cup soybean oil

Small saucepan

Stove top or other heat source

PROCEDURE:

Place the beeswax pellets in a small saucepan. Heat on low-medium heat. Stir until all beeswax is melted. Add soybean oil to the melted beeswax, stir and remove from heat. Pour 1 tablespoon into each small cup.

Let solution sit until it hardens to a soft solid. Use fingertip to transfer the lip balm from cup to lips, or remove paper cup and use the wax cylinder to coat lips.

What is beeswax?

A beehive is filled with little rooms called cells where the bees raise their young and store pollen and honey for the winter. These small cells each have six sides – they are hexagons. The bees make these cells out of beeswax.

A bee has special parts on its underside, called glands, that produce wax. When the worker bees eat honey, these special wax-producing glands change the sugar into wax. Bees must eat eight ounces of honey for every one ounce of wax they produce.

The wax appears as small flakes on a bee's underside. The bees must chew the wax in order to soften it, so they can shape it into cells. Beeswax is used in many products, including skin lotions, dental floss, jelly beans, gummy bears, candles, and medicines.