

California Educator's Guide to

Fun with the Plant Nutrient Team



Grades K-3

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California Foundation for Agriculture in the Classroom

Vision: An appreciation of agriculture by all.

Mission: To increase awareness and understanding of agriculture among California's educators and students.



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PLANT NUTRITION
INSTITUTE

www.ipni.net

 cdfa CALIFORNIA DEPARTMENT OF
FOOD & AGRICULTURE



California Foundation for Agriculture in the Classroom is dedicated to fostering a greater public knowledge of the agriculture industry. The Foundation works with K-12 teachers, community leaders, media representatives, and government executives to help young people make informed choices by incorporating agricultural examples into classroom curriculum.

The Educator's Guide to Fun With the Plant Nutrient Team was designed as a support piece to the activity book, for grade K-3 students, from the Nutrients for Life Foundation and the International Plant Nutrition Institute. The *Educator's Guide* was funded by California Department of Food and Agriculture's Fertilizer, Research, and Education Program (FREP) and developed by California Foundation for Agriculture in the Classroom.

The purpose of the *Educator's Guide* is to provide teachers with extension lessons to build upon topics in the *Fun With the Plant Nutrient Team* activity book, which was written to help children better understand what the soil needs to be healthy in order to provide us with healthy foods. The lessons in the *Educator's Guide* are aligned to California Standards for California Public schools, including the Common Core and Next Generation Science Standards. The lessons encourage students to think for themselves, ask questions, and learn problem-solving skills while learning the specific content needed to better understand the world in which they live.



People and Plants Need Nutrients

Purpose

In this lesson, students will learn that although plants and people obtain nutrients differently, they both need proper amounts of nutrients to grow and be healthy.

Extension

Fun With the Plant Nutrient Team student activity book on pages 1, 2, 3, 5, 7, 8, 9, 11, 12, 13, 23.

Time

One 50-minute class session

California Standards

This lesson addresses K-3 Common Core State Standards for English Language Arts and Next Generation Science Standards.

Standards alignment is listed in the matrix on page 37.

Materials

For each student:

- *Fun With the Plant Nutrient Team* student activity book
- *People and Plants Need Nutrients* student handout on pages 3-4

Background Information

Plants depend on the soil for the nutrients they need to grow and be healthy. If the soil does not contain the right amount of nutrients, the farmer or gardener will need to add one or more nutrients to the soil. Plants obtain three of these essential nutrients—carbon, hydrogen and oxygen—from the atmosphere and water. Nitrogen, phosphorus, and potassium are classified as primary macronutrients because plants consume large amounts of these nutrients and therefore, they may be lacking in the soil. Secondary macronutrients include calcium, magnesium, and sulfur and are often present in the soil in amounts that are sufficient for plant growth.

The remaining essential nutrients are called micronutrients. Micronutrients are just as important for plant health as the macronutrients, but are required in much smaller amounts. Micro and macronutrients are obtained when plant roots take up water from the soil that contains the dissolved nutrients. Altogether, there are 17 nutrients that plants require for healthy growth and development. The chemical symbol for each of these nutrients is shown on the last page of your *Fun With the Plant Nutrient Team* activity book.



Both plants and people need nutrients to grow strong and be healthy. While plants use their roots to absorb nutrients from soil through water, people must get their nutrients by eating a balanced diet of nutritious foods.

The *People and Plants Need Nutrients* chart shows a list of the nutrients that are highly important for plant growth and why those nutrients are also important for people.


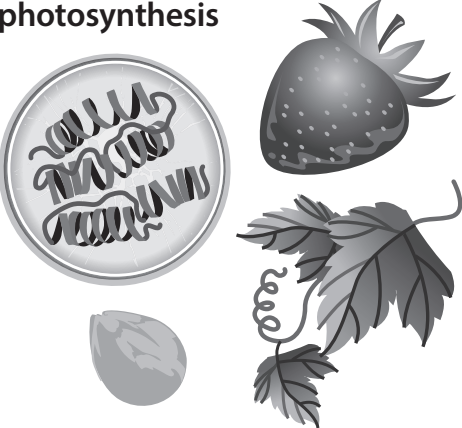


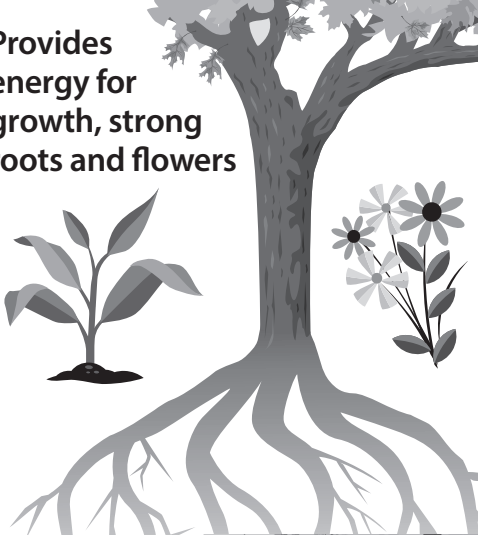
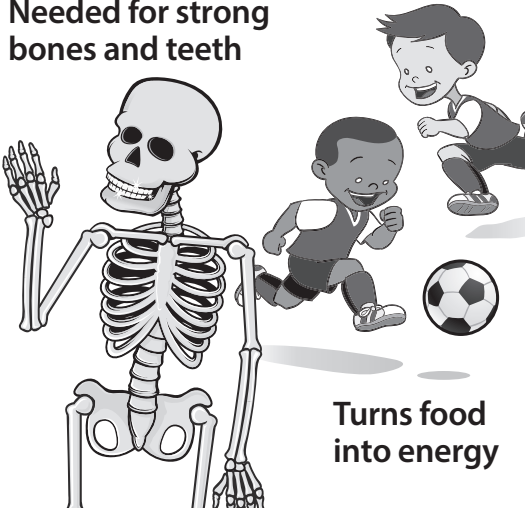


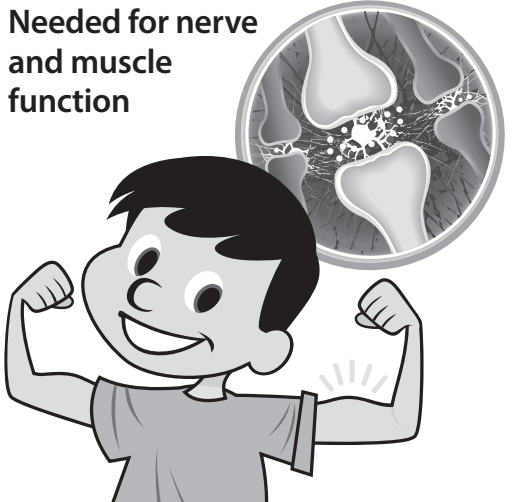
Procedure

Have students complete some of the corresponding pages in the *Fun With the Plant Nutrient Team* student activity book.


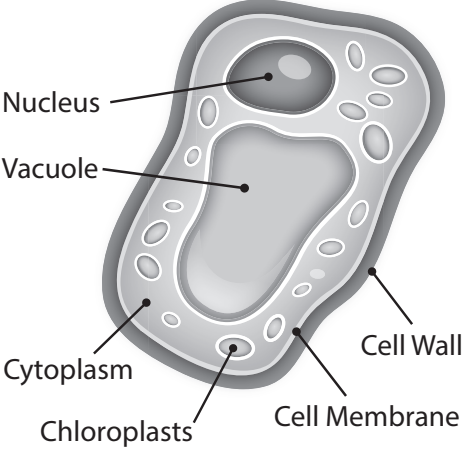
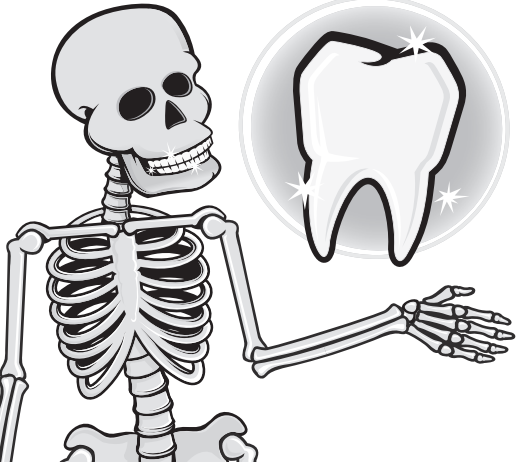

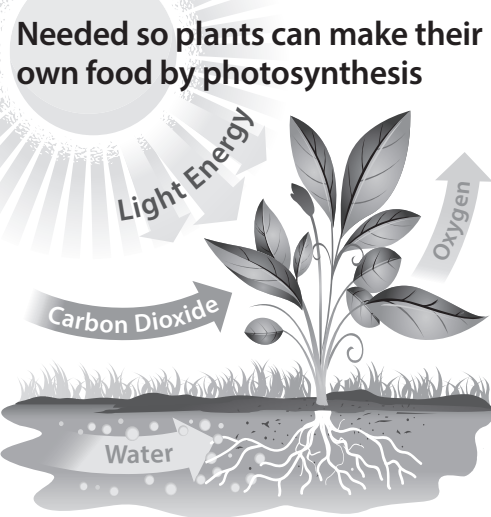


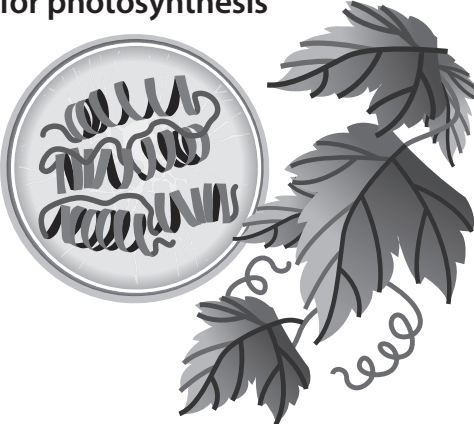
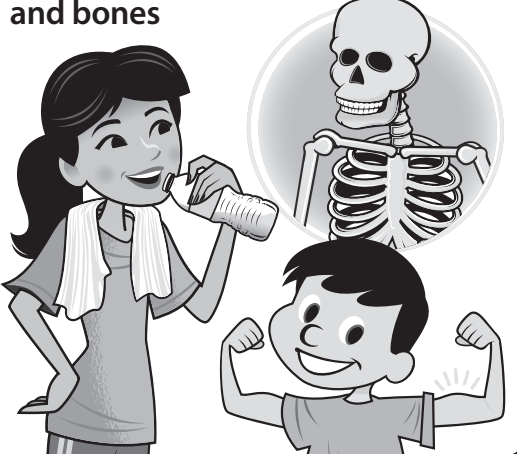
1. Ask students if they know why it is important to eat healthy foods. Explain that healthy foods supply our bodies with the nutrients they need for energy, growth, and repair. Ask students to help make a list of some healthy foods they can include in a meal or snack. Give an example of foods that are good sources of certain nutrients. For example, milk is a good source of calcium, oranges are a good source of vitamin C, and bananas are a good source of potassium.
2. Ask students if plants need food. Explain that plants, just like people, need food for energy, growth, and repair, but they do not eat food like people do. Instead, plants make their own food by capturing energy from sunlight to carry out a process called photosynthesis. Chlorophyll is the pigment inside leaves that gives them their green color and makes grass stains on your clothes. It helps plants absorb energy from the sun to make their own food.
3. Ask students to help you make a list on the board of what plants need in order to make their own food. Write the words and draw the symbols for sun, water, and soil on the board. Next, draw a simple plant on the board and show its roots growing down into the soil. Explain that most of the nutrients a plant needs come from the soil. Plants get these soil nutrients when their roots absorb them along with water.
4. Distribute the *People and Plants Need Nutrients* chart to each student. As a class, review the chart to discuss what nutrients are important to plants and people. Use the questions that follow as group work or individual assignments for each student.

Note: The plant nutrients shown in the chart are called macronutrients because plants use large amounts of these nutrients. Micronutrients are nutrients that are just as important for plant growth but are needed in much smaller amounts. These are iron, manganese, chlorine, zinc, boron, molybdenum, copper, nickel, hydrogen, carbon, and oxygen.

People and Plants Need Nutrients

Nutrient	Why plants need it	Why people need it
<p>Nitrogen (N)</p> 	<p>Makes proteins, fruits, seeds, and chlorophyll to carry out photosynthesis</p> 	<p>Makes protein for strong muscles</p> 
<p>Phosphorus (P)</p> 	<p>Provides energy for growth, strong roots and flowers</p> 	<p>Needed for strong bones and teeth</p> <p>Turns food into energy</p> 
<p>Potassium (K)</p> 	<p>Helps plants fight disease and build strong stems</p> 	<p>Needed for nerve and muscle function</p> 

People and Plants Need Nutrients

Nutrient	Why plants need it	Why people need it
<p>Calcium (Ca)</p> 	<p>Helps build new cells</p> 	<p>Keeps bones and teeth strong</p> 
<p>Magnesium(Mg)</p> 	<p>Needed so plants can make their own food by photosynthesis</p> 	<p>Helps fight disease and keeps nerves and muscles functioning</p> 
<p>Sulfur (S)</p> 	<p>Makes proteins and chlorophyll for photosynthesis</p> 	<p>Needed for healthy skin, muscle and bones</p> 

People and Plants Need Nutrients

Name _____

Work with a partner and use the *People and Plants Need Nutrients* chart to answer the following questions.

1. Are there any nutrients that do the same thing in people and plants? _____

What are they? _____

2. What nutrients are important for keeping plant leaves green and helping the plant make its own food? _____

3. What would happen to the plant if it could not make enough of its own food? _____

4. What would happen to you if you did not get enough nutrients? _____

5. You notice that the tomato plants you planted have not had any flowers and the roots have not grown much. What nutrient could your soil be lacking? _____

6. What can farmers and home gardeners do to make sure their plants have the nutrients they need to be healthy? _____

People and Plants Need Nutrients

ANSWER KEY

Work with a partner and use the *People and Plants Need Nutrients* chart to answer the following questions.

1. Are there any nutrients that do the same thing in people and plants? Yes.
What are they? Nitrogen and phosphorus.
2. What nutrients are important for keeping plant leaves green and helping the plant make its own food? Nitrogen, phosphorus, magnesium, and sulfur.
3. What would happen to the plant if it could not make enough of its own food? _____
The plant would not grow very much and could become sick with disease and die.
4. What would happen to you if you did not get enough nutrients? _____
If you don't get the right amount of nutrients you won't grow big and strong and your immune system wouldn't be able to fight off disease.
5. You notice that the tomato plants you planted have not had any flowers and the roots have not grown much. What nutrient could your soil be lacking? Nitrogen.
6. What can farmers and home gardeners do to make sure their plants have the nutrients they need to be healthy? Farmers and home gardeners can test their soil to find what nutrients are available for their plants. If needed, they can add nutrients from the appropriate fertilizer.



The Soil We Grow In

Purpose

In this lesson, students will gain an understanding and appreciation for the importance and complexity of the Earth's soil.

Extension

Fun With the Plant Nutrient Team student activity book on pages 4, 16, 23.

Time

Two or three 50-minute class sessions

California Standards

This lesson addresses K-3 Common Core State Standards for English Language Arts and Mathematics, and Next Generation Science Standards. Standards alignment is listed in the matrix on page 37.

Materials

Part A: Comparing Apples and Earth

For the teacher:

- Copy of *Comparing Apples and... Earth?* found at www.LearnAboutAg.org/agbites

For each student:

- Apple
- Plastic knife
- Cutting board or plates
- Paper towels or wet wipes

Part B: Shake, Rattle & Roll

For the teacher:

- Copy of *Shake, Rattle & Roll* found at www.LearnAboutAg.org/wegarden

For each group:

- Flour
- Sugar
- Water
- Glass jar with lid
- Soil
- Permanent marker
- Ruler
- Paper towels

Part C: What's Soil Made Of?

For the teacher:

- Soil samples from a variety of locations
- Paper cups

For each group:

- Two or three paper cups with a different soil sample in each
- Plastic spoon
- White paper
- Hand lenses

For each student:

- *What's Soil Made Of?* handout

Procedure

This lesson is divided into three parts.

In Part A, students will complete the *Comparing Apples and...Earth?* activity, which explores the amount of Earth's surface that is available for growing food.

In Part B, students will complete the *Shake, Rattle, & Roll* activity to learn about different types of soil particles.

In Part C of the lesson, students will analyze soil samples to investigate the various components of soil.

1. Gather materials and instruct students in the procedures for *Comparing Apples and...Earth?*
2. Gather materials and instruct students in the procedures for *Shake, Rattle, & Roll*
3. For Part C, gather samples of soil from a variety of places around your school or home garden. You can also have the students bring samples of soil from home. Do not use purchased potting soil for this activity.
 - a. Divide soil samples into paper cups, with two to three different soil samples for each student group.
 - b. Distribute the student handout *What's Soil Made Of?* and read as a class. Demonstrate the procedure for the class, then divide students into groups. Walk younger students through each soil sample one at a time as a class.
 - c. Instruct one student from each group to obtain cups of soil samples.
 - d. Use the questions that follow as a class discussion for younger students. Have the older students complete the answers to the questions in their groups. Discuss why it is important for farmers to understand the properties of the soil on their farms.

Note: This lesson uses various models to illustrate concepts. Remind students that models incorporate approximations that may not represent the exact properties of soil.

What's Soil Made Of?

Name _____

The Earth's soil is a very important resource. Without healthy soil we would not be able to grow the plants we need for food, fiber, and shelter. There are many different types of soil and each is made up of different components, not just dirt!

The rock material in soil has been broken down over a very long time into smaller and smaller pieces by "weathering," which happens when rock and soil are exposed to wind, water, and changing temperatures. Water and air are also found in soil. Water, air, and rock particles are the inorganic components of soil, which means these components are not living and never were living. The organic components in soil are living, or were once living, organisms. Examples of organic soil materials include decayed plant and animal waste, worms, insects, bacteria, and more. Healthy soil is a mixture of a variety of inorganic and organic materials.

In this activity you will carefully dissect a soil sample to find out what it is made of. Farmers carry out soil tests like this on a regular basis. Farmers want to know the properties of their soil because it plays a role in the amount of nutrients that are available for plants to use.

Procedure

1. Obtain soil samples from your teacher.
2. Take a spoonful of soil from one sample and spread it out on your piece of white paper.
3. Look at soil components carefully and try to separate the different components. Use the magnifying glass for help identifying tiny objects in the soil.
4. Make a sketch of what you see in your soil sample and repeat the process for each sample. Answer the following questions for each sample.

What's Soil Made Of?

Soil Sample 1

What color is the soil sample? (*dark brown, light brown, reddish brown, gray, orange, etc.*)

How does it feel when you rub the soil between your fingers? (*sandy, smooth, slippery, sticky, spongy*)

What kinds of things can you see in the sample? (*leaves, twigs, rocks, sand, worms, insects, etc.*)

Soil Sample 2

What color is the soil sample? (*dark brown, light brown, reddish brown, gray, orange, etc.*)

How does it feel when you rub the soil between your fingers? (*sandy, smooth, slippery, sticky, spongy*)

What kinds of things can you see in the sample? (*leaves, twigs, rocks, sand, worms, insects, etc.*)

What's Soil Made Of?

Soil Sample 3

What color is the soil sample? (*dark brown, light brown, reddish brown, gray, orange, etc.*)

How does it feel when you rub the soil between your fingers? (*sandy, smooth, slippery, sticky, spongy*)

What kinds of things can you see in the sample? (*leaves, twigs, rocks, sand, worms, insects, etc.*)





Photosynthesis and You

Purpose

In this lesson, students will learn about the process by which plants make their own food. Students will understand how photosynthesis provides the food they eat.

Extension

Fun With the Plant Nutrient Team student activity book on pages 6, 9, 10.

student activity book

For the class experiment:

Time

One 45-minute session for activity sheet
Two weeks for experiment

- Three identical plants: One planted in potting soil, two planted in sand
- One heavy, brown paper bag

California Standards

This lesson addresses K-3 Common Core State Standards for English Language Arts and Next Generation Science Standards. Standards alignment is listed in the matrix on page 37.

For each student:

- *Fun With the Plant Nutrient Team* student activity book
- *Photosynthesis and You* handouts pages 16-17
- Crayons, colored pencils, or markers

Materials

For the teacher:

- *Fun With the Plant Nutrient Team*

Background Information

Photosynthesis is the process by which plants and some algae and bacteria capture sunlight energy to make their own food.

The inputs for photosynthesis are sunlight, carbon dioxide, and water. The outputs are oxygen and carbohydrates in the form of sugars or starch.

People would not have food to eat if it weren't for photosynthesis. Plants need the process to make their food, and people and other organisms depend on consuming plants or other organisms that eat plants. Plants and animals are interdependent; plants need the carbon dioxide that animals release during respiration and animals need the oxygen released by plants during the process of photosynthesis.

Plant leaves are the main site of photosynthesis. The chemical chlorophyll allows special cell structures called chloroplasts to absorb light energy. Carbon dioxide passes through the stomata on the underside of the leaves and moves to the cells where energy from the sun has been trapped and stored. Water is absorbed by the root hairs and transported up the stem. Through a chemical reaction, water and carbon dioxide are converted into carbohydrates that are used by the plant for energy and growth. Oxygen is released from the plant into the atmosphere.

Plant Experiment Procedure

Have students turn to page six in their *Fun With The Plant Nutrient Team* student activity book. Explain that they will be carrying out this experiment as a class.

Explain that plants A, B, and C are all the same types of plants and are the same age. *Note: tomato seedlings work well for this experiment.* The class will note their observations of the three plants on days 1, 4, 7, 11, and 14 on page six.

1. Show students that Plant A is planted in sand and will be watered with distilled water. Explain that distilled water has been filtered so it does not contain any minerals or nutrients. Plant A will be set in a place where it receives sunlight for most of the day.
2. Show students that Plant B is planted in potting soil that contains the important nutrients for plant growth. Plant B will be watered with tap water and will be set in a place where it receives sunlight for most of the day. Explain that tap water has been treated so it is safe for people to drink and may also contain some minerals.
3. Show students that Plant C is planted in sand and will be watered with tap water. Place Plant C inside a heavy brown paper bag so it does not receive sunlight.
4. Ask students to predict which plant will be the healthiest at the end of the experiment and why. Tally votes on the board and make a bar graph of class predictions.
5. Give all three plants the same amount of water on the same days as needed.
6. Allow students 5-10 minutes to observe the plants and write down their observations on days 1, 4, 7, 11, and 14. Older students can write down notes with descriptive observations while younger students can use the smiley faces on page six.
7. On day 14 of the experiment, compare the results with the class predictions. What plant is the healthiest and why? What plant did not do well and why? Discuss these questions and answers as a class.

-
8. Explain that Plant C did not get sunlight and therefore, was not able to carry out photosynthesis to make its own food. When a plant cannot make its own food, it doesn't have energy to carry out life processes and it will become sick or die. Plant C was also planted in sand, which does not contain the nutrients that are important for plants to survive.
 9. Explain that Plant A was planted in sand, which does not contain the nutrients that are important for plants to survive. It was also watered with distilled water, which doesn't have any nutrients. For these reasons, plant A didn't grow much and wasn't very healthy at the end of the experiment.
 10. Explain that Plant B is likely the healthiest because during the experiment it received everything a plant needs to grow and be healthy. Plant B received sunlight, water, and potting soil that contained important nutrients for plant growth.
 11. Ask students why it is important to have healthy plants that can carry out the process of photosynthesis. Explain that we depend on photosynthesis for plants to make the food that we eat. Use a bowl of cereal and milk as an example. Where did the wheat, rice, or corn in the cereal come from? (plants) Where did the milk come from? (a cow) What do cows eat? (plants/grass)
 12. Show students an animated video of the photosynthesis process:
www.sites.ext.vt.edu/virtualforest

Worksheet Procedure

1. Provide the student handout, *Photosynthesis and You*, to older students and read aloud as a class. For younger students, summarize the main points of the reading to provide background information for the drawing activity.
2. Lead students through the photosynthesis drawing activity step by step.

Photosynthesis and You

Did you know that plants are able to make their own food? The word “photo” means light, and the word “synthesis” means putting together. The word photosynthesis means putting together with light, which is exactly what happens as plants make their own food with the energy of the sun.

Plants take in the water and nutrients they need for photosynthesis from the soil through their roots. The water and nutrients are moved through tiny root hairs into the roots, and then travel up the stem, in special tubes, to the leaves where photosynthesis takes place.

During photosynthesis, the trapped energy from the sun, carbon dioxide from the air, and water come together to make the plant’s “food” and oxygen. The food provides energy the plant needs to grow, or it is stored in parts of the plant as sugar or starch for later use. The oxygen is released through the tiny holes in the leaf out into the atmosphere.

When you eat plant parts such as potatoes, apples, celery, and raisins, you are using the plant’s stored energy to do all the things your body needs to do.

Now you know that you and the Earth’s plants have a very important relationship. You need each other! Plants cannot survive without the carbon dioxide that you breathe out and you cannot live without the oxygen and food that comes from plants.

"Photosynthesis and You" Drawing

Name _____

Directions

1. Draw a tomato or corn plant on a piece of paper making sure you include roots, stems, and leaves.
2. Add the sun and put arrows showing how it shines on your plant leaves.
3. Now add soil.
4. Add water droplets to the soil.
5. Write carbon dioxide in the air and put an arrow from the carbon dioxide into the leaf.
6. On the other side of your leaf, write the word "oxygen" and put an arrow showing that oxygen is coming out of the leaf.
7. Your plant is carrying out the process of photosynthesis. It is also growing food for you to eat. Draw a tomato on your tomato plant or an ear of corn on your corn plant.
8. Draw a picture of you eating the tomato or corn.
9. Under your picture, explain why photosynthesis is important to you.



Satellites and Agriculture: The Sky and the Land

Purpose

In this lesson, students will learn how modern farmers use technology to ensure that plants are getting the right nutrients in the right amounts.

Extension

Fun With the Plant Nutrient Team student activity book on pages 14, 15.

Time

One or two 50-minute sessions

California Standards

This lesson addresses K-3 Common Core State Standards for English Language Arts and Next Generation Science Standards. Standards alignment is listed in the matrix on page 37.

Materials

For the class:

- Computer and Internet access

For each student:

- *Fun with the Plant Nutrient Team* student activity book

Background Information

Today's farmers work in a complex and innovative field. Just as technology is an integral part of business and our personal lives, it also has an expanding role in farming and ranching. Simply plowing the land and sowing seeds are practices of the past.

Farmers and ranchers can get an accurate picture of what is happening on their land by satellite imaging. They don't just drive through their fields and pastures anymore. Satellite imagery can provide a farmer with a map that gives them an overall view of the entire field, and can help ranchers monitor how much vegetation their livestock is consuming. In addition, farmers and ranchers use satellite imagery to keep an accurate record of their land for insurance purposes.

A farmer today is able to create computer models of fields that use collected data to pinpoint differences in soil structure, elevation, slope, available plant nutrients, and drainage. Models like these help farmers to make more efficient use of water and plant nutrients and also help calculate the amount of seed to plant for different crops. This modern technology benefits consumers by helping farmers produce more food at a lower cost while protecting land and water resources.

Many modern farm tractors have air conditioned cabs with computers and GPS systems that guide farmers as they work their fields. These modern systems help farmers ensure that they don't over seed or under seed a field, and that the proper amount of the right nutrient is applied to their plants. Computers are also used in programming irrigation systems to apply the precise amount of water through analysis of the crop needs.



The use of satellite technology and computers continues to provide innovation in agriculture. In 2014 a new NASA satellite called Soil Moisture Active Passive (SMAP) will be launched to help the USDA forecast drought conditions and predict crop production by understanding how much water will be available for farming.

We all rely on farmers and ranchers. It is important to understand how they use technology to improve production of our food and fiber while being good stewards of the land for future generations.

Following are links to a variety of lessons that you can do with your students. These lessons can be simplified or expanded depending on the grade level and needs of your class.

The Tools of Agriculture

Grades: K-6

This lesson helps students identify tools and machines used in the production of agricultural products, and discusses some of the types of energy used in agriculture.

www.munnellrunfarm.org/uploads/Lesson%20Tools/The_Tools_of_Agriculture.pdf

Science NetLinks: Modern Technology and Farming

Grades: K-5

This is an open-ended lesson that examines the role of technology in farming while exploring five different kinds of farms. It includes extensions and has a link to a 4-H virtual farm activity. Students examine how modern farming technology has increased farming efficiency.

www.sciencenetlinks.com/lessons/modern-technology-and-farming

Old McDonald had an iPad

Grades: 3-8

This lesson looks at how agricultural challenges in the past have been solved through the use of technology. What kinds of challenges do farmers face today? What tools do they use to help them fix the problems? This lesson supports STEM and social studies curriculum with a video that profiles a California pistachio farmer who developed an iPad app to improve irrigation. As an extension, use the accompanying lesson plan to have students research historical and contemporary agricultural innovations.

www.pbs.org/america-revealed/teachers/lesson-plan/4/



A Plant's Life

Imagine this... Story Writing Contest

Purpose

In this lesson students will investigate the process of planting, growing, and harvesting a particular crop and getting that crop onto tables in homes across the world.

Extension

Fun With the Plant Nutrient Team student activity book on pages 16, 17.

Time

Dependent upon the class structure, students will need research, writing, and editing time either in class or as homework.

California Standards

This lesson addresses K-3 Common Core State Standards for English Language Arts and Next Generation Science Standards. Standards alignment is listed in the matrix on page 37.

Materials

For the class and each student:

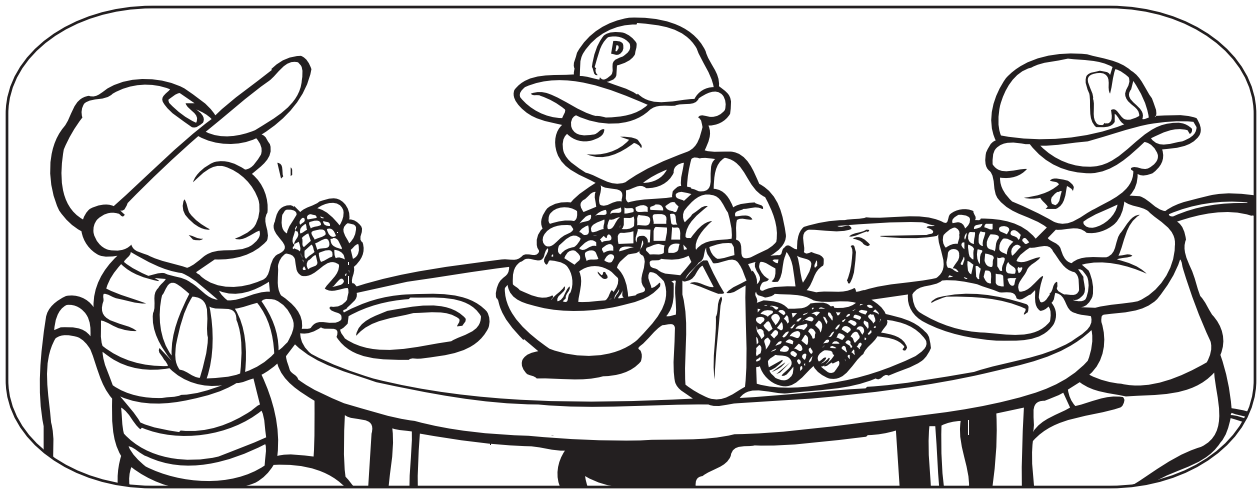
- Access to research materials, including the Internet
- *Fun With the Plant Nutrient Team* student activity book

Procedure

1. As a class, review pages 16 and 17 in the *Fun With The Plant Nutrient Team* student activity book.
 - a. Discuss how page 16 outlines the steps that begin with the farmer planting corn and end with kids eating the corn. Ask students if they can come up with ideas about the details that take place in each caption. For example, how does the farmer know when the crop is ready to be harvested? How does the farmer find a buyer for the crop? How does the farmer decide what type of corn to plant?
 - b. Discuss how page 17 illustrates the steps it takes to get plant food or nutrients to the farmer. Ask students if they know what kind of food plants eat. Review examples of plant nutrients from pages 7-13 in the *Fun With The Plant Nutrient Team* student activity book.
2. Explain to students that they will be choosing a crop to write a story about. Their story should teach readers how a crop is planted, grown, harvested, and shipped to grocery stores and homes. Younger students may write their stories as illustrations with captions. For older students, use guidelines from the *Imagine this...* Story Writing Contest.

-
3. For grades 3-8, submit stories to the *Imagine this...* Story Writing Contest. State-winning authors will have their stories published in an illustrated book that is distributed to school libraries and classrooms across the state.

Visit www.LearnAboutAg.org/imaginethis for contest guidelines, list of awards, and previous winning stories.





Weather on the Farm

Purpose

In this lesson, students will use on hands-on activities to learn about the water cycle and which areas of California have the best climates for growing different crops.

Extension

Fun With the Plant Nutrient Team student activity book on page 18.

Time

Two 45-minute sessions

California Standards

This lesson addresses K-3 Common Core State Standards for English Language Arts and Next Generation Science Standards. Standards alignment is listed in the matrix on page 37.

Materials

For the teacher:

- *Fun With the Plant Nutrient Team* student activity book
- *Water Cycle in a Cup* directions
www.LearnAboutAg.org/agbites

For each pair of students:

- Plastic cup
- Plastic wrap
- Water
- Tape
- Crayons

For each student:

- *Fun With the Plant Nutrient Team* student activity book
- Landform Handout for *Water Cycle in a Cup*
- *California Grows Map* handout on page 34

Background Information

Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. Weather is very important to farmers and it dictates when they plant, irrigate, feed, and harvest their crops. Weather is also important to consumers. If crops are damaged by weather events, this could cause a rise in prices at the grocery store as demand becomes higher than supply. While farmers cannot control the weather, they can sometimes do things to help their crops during potentially harmful conditions. For example, if there is danger of freezing weather, citrus farmers can put big fans in their orchards to keep air moving so the trees stay warmer and fruit on the trees does not freeze.

Climate is the weather of a particular region over a series of years. California has many different climate zones, which enable farmers in our state to grow a wide variety of crops. For example, our coastal climates have mild temperatures throughout the year, which make them good for growing cool weather crops like artichokes. Our foothill climates have cool, moist winters and hot, dry summers, which are good for growing crops like grapes and apples.

Farmers aren't the only ones interested in weather. The oldest continually published periodical in the country is the *Old Farmer's Almanac*, first published in 1792 when George Washington was president. Farmers, home gardeners, and outdoor enthusiasts are still referring to the Almanac for weather forecasts, planting days, tide tables, and more.

Two things that greatly affect the weather are the Earth's water and sun. Water collects in the oceans, lakes, ponds, rivers, and streams. As the water is warmed by the sun, it heats up. When the water molecules heat up they move faster and faster until they become a gas and rise into the sky as water vapor. This is called **evaporation**. Once the water molecules get away from the heat on the land they start to cool down again and come back together as a liquid. This is called **condensation**. As the water molecules collect together they get heavier and heavier and then fall back down to the earth. This is called **precipitation**. Precipitation can be in the form of rain, sleet, snow, or hail. Some precipitation soaks into the ground in a process called **infiltration**, and some precipitation does not soak into the ground and instead moves over the surface of the ground as **runoff** until it returns to a body of water. Plants release water vapor from tiny holes in their leaves into the atmosphere. This process is called **transpiration**. Your class will simulate the water cycle process with the *Water Cycle in a Cup* activity.

Water Cycle in a Cup

Procedure

Summarize the background information for your students through a class discussion and notes on the board.

Organize students into groups of two and explain the directions for the *Water Cycle in a Cup* activity. Review key vocabulary that are labeled on the water cycle diagram and make sure students understand their meaning.

At the end of the activity, discuss with your class why weather is important to farmers, and how its impact on farmers affects everyone else. Make sure to talk about supply and demand and how weather events can impact the amount of money our families spend on food.

Where Should I Grow It?

Procedure

Provide students with the *California Grows Map* (page 34). Explain that the map shows each county and some of the top crops that are produced there.

Discuss how the climate on the north coast would be different from the climate in the Sierra Nevada Range or in the south eastern desert region of our state. See if your class can find any patterns in the types of crops that are grown in different regions. Explain that some crops do best in hot, dry climates while others do best in mild, moist climates.

At the bottom of their map instruct students to write down the following crops then draw an arrow to a region on the map where they think those crops would grow well.

1. **Citrus trees:** Grow best in areas that have little chance of freezing during the winter and have warm, dry summers.
2. **Strawberries:** Grow well in areas with warm, sunny days, and cool, foggy nights.
3. **Cotton:** Grows best in areas that have warm springtime weather, hot summers, dry falls and wet winters.
4. **Tomatoes:** Grow best in areas with warm days, cool nights, and fertile soil found in valleys where rivers have deposited rich soil.
5. **Apples:** Grow well in valleys of the foothills and northern coastal mountains where the winters are cool and wet and the summers are mild to hot.
6. **Redwood trees:** Need cool climates with a lot of fog and rainfall.



Where Did Your Hamburger Come From?

Purpose

In this lesson students will learn about the variety of agricultural products they consume in a hamburger and will trace the ingredients back to their source.

Extension

Fun With the Plant Nutrient Team student activity book on pages 20, 21, 22.

Time

One 45-minute session

California Standards

This lesson addresses K-3 Common Core State Standards for English Language Arts and Next Generation Science Standards. Standards alignment is listed in the matrix on page 37.

Materials

For the teacher:

- *Fun with The Plant Nutrient Team* student activity book
- *California Grows Map* page 34

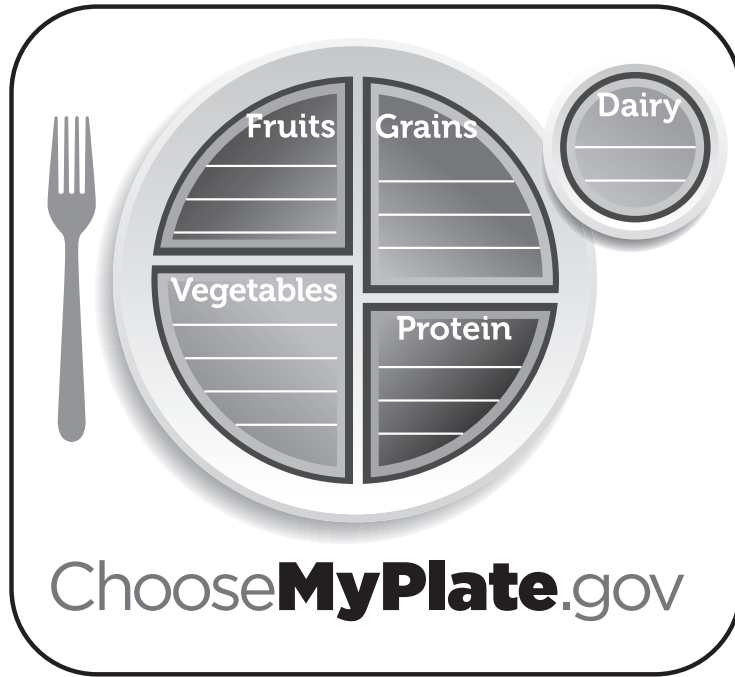
For each student:

- *Where Did Your Hamburger Come From?* handouts pages 32-35
- *Fun with The Plant Nutrient Team* student activity book
- Scissors
- Pencils, crayons, colored pencils, or markers
- Glue
- Paper plate

Background Information

Many students don't think about the source of their food beyond the grocery store or the importance of California agriculture in their daily lives. Students may be surprised to learn about all the different commodities in the ingredients of something as familiar as a hamburger. Mustard is just one example. Mustard is made from the seeds of a mustard plant and spices such as garlic powder and turmeric. Mustard is likely a plant that most students have not seen, but there are farmers in our state who grow mustard plants to harvest seeds for spice blends and mustard condiments. Emphasize to students that from growing a crop to harvesting, processing, and transportation, it takes many different people and steps to provide the ingredients for a simple meal.

MyPlate recommends that we fill half of our plates with fruits and vegetables at each meal.



A hamburger will often contain a food from each of the food groups. The food groups and recommended servings for children ages four to eight years old are:

Food Group	Recommended Daily Servings for Children 4-6 Years Old	Example of One Serving
Grains	4-5	1 slice of bread, 1 cup of cereal, ½ cup cooked rice or pasta
Vegetables	1-1½	1 cup of raw or cooked vegetables, or 2 cups of raw leafy greens
Fruits	1-1½	1 cup of fruit or 100% fruit juice, or ½ cup of dried fruit
Dairy	2-2½	1 cup of milk or yogurt, 1½ oz of cheese
Protein	3-4	1 oz of meat, ¼ cup cooked dry beans, 1 egg, 1 tablespoon of peanut butter, or ½ oz of nuts or seeds
Oils	3-4	1 teaspoon unsaturated vegetable oil

Procedure

1. Ask students if they like to eat hamburgers and have them help you make a list on the board of their favorite hamburger ingredients and toppings. Once you have your list, ask students which of the items came from a farm or ranch and then make a check mark by those items. Explain that the class will be doing an activity to learn more about the ingredients of the hamburger and where they come from.
2. Provide students with the handout of the hamburger parts and have students color them and cut them out according to directions.
3. After students have colored, cut out, and pasted their hamburger parts on their plate, discuss each part as you draw the hamburger components on the board.
4. Show students the *California Grows Map* by projecting it on a screen or have them refer to their own handout on page 34. Next to each hamburger part on their plate, instruct students to write down the source of the main ingredient and use the map to locate a county where it is produced. Label the food group for each part of the hamburger.
 - a. For items like pickles and onions, remind students that these are vegetables and they should look on the map for counties that have vegetable crops listed.
 - b. Note: Many different commodities are produced throughout the state. A listing of a commodity in one or several counties on the map does not mean that is the only county that produces that commodity. The listed county simply produces the listed commodities as one of their top commodities.
5. Display or draw the MyPlate graphic on the board. An electronic version of this graphic is available at www.choosemyplate.org.
 - a. Ask students if the hamburger meal contains a serving of each of the food groups represented on MyPlate. Ask students to help you make a list of foods that could be added to make this a balanced meal.

Where Did Your Hamburger Come From?

Name _____

Introduction

Have you ever taken a bite of a hamburger and wondered where all of the ingredients came from? Depending on what you put on your burger, it may contain foods from every food group. Who are the people who grew the ingredients? A rancher probably raised the beef cattle for the beef patty and a tomato farmer grew the tomatoes for the ketchup and tomato slice, but what about the bun, cheese, onions, mayonnaise, pickles and other ingredients you like on your burger?

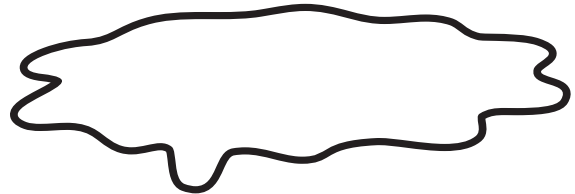
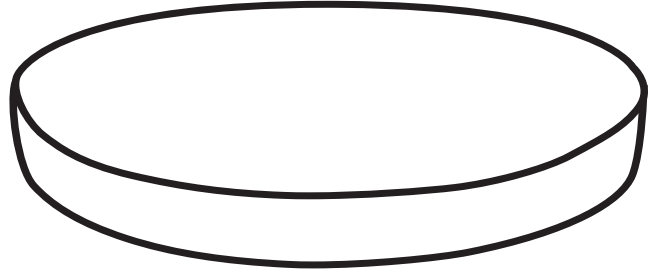
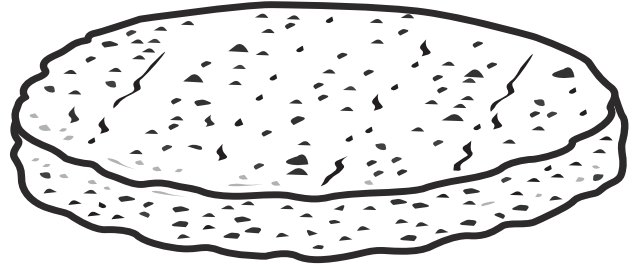
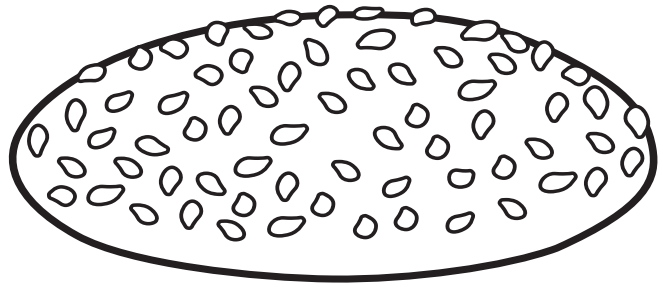
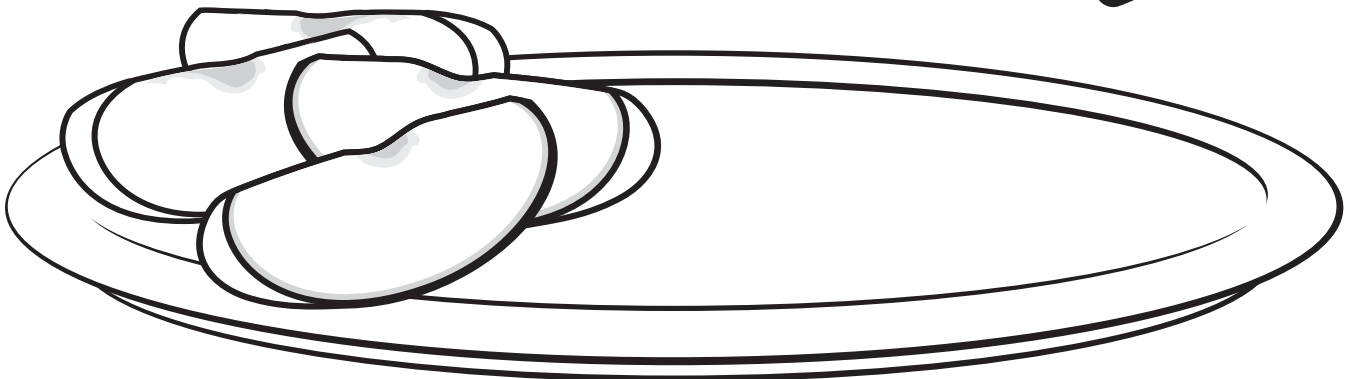
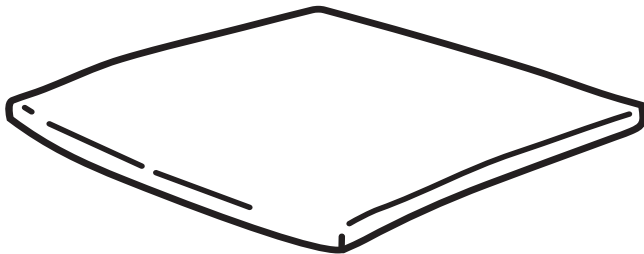
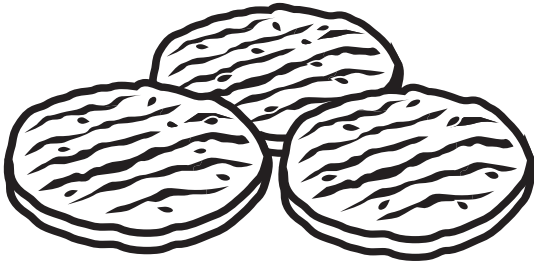
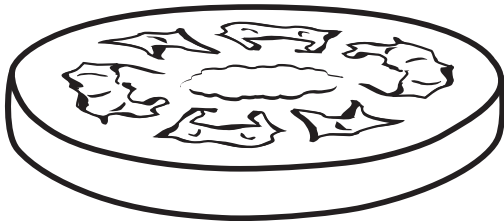
In this activity, you will put together your own hamburger and learn about some of the different products farmers and ranchers produce for your dinner. You will also learn about the different food groups that go into this meal.

Directions

1. Color the different parts of the hamburger.
2. Cut out each part and glue them onto a paper plate.
3. Your teacher will provide a map of California that shows some of the top crops grown in each county. As a class, find the county where the source of each of your hamburger ingredients was produced. Next to each of your hamburger ingredients write down the source of the ingredient and the county where it could have been grown.
4. Write down the food groups that are represented in your hamburger ingredients. Health guidelines recommend that we fill half of our plate with fruits and vegetables at each meal. As a class, discuss ways to make this a balanced meal.

Build your own burger!

Cut out the hamburger parts and put them together just the way you like...



California Grows Map



Where Did Your Hamburger Come From?

Hamburger Part	Source	Who Produced It?	Food Group
Beef patty	Beef cattle		Protein
Bun	Wheat kernel		Grain
Ketchup	Tomatoes		Vegetable
Cheese	Dairy cow		Dairy
Mayonnaise	Olive tree		Oils and Fat
Lettuce	Lettuce plant		Vegetable
Tomato slice	Tomato plant		Vegetable
Pickle	Cucumber plant		Vegetable
Onion slice	Onion bulb		Vegetable
Apple slices	Apple tree		Fruit

Where Did Your Hamburger Come From?

ANSWER KEY

Hamburger Part	Source	Who Produced It?	Food Group
Beef patty	Beef cattle	<i>Rancher in Alpine, Calaveras, Contra Costa, Del Norte, Imperial, Inyo, Nevada, Mariposa, Plumas, Sierra and other counties</i>	Protein
Bun	Wheat kernel	<i>Wheat farmer in Modoc and other counties</i>	Grain
Ketchup	Tomato plant	<i>Tomato farmer in Solano, Yolo, and other counties</i>	Vegetable
Cheese	Dairy cow	<i>Dairy farmer in Marin, Merced, San Bernardino, San Joaquin, Stanislaus, Tulare, and other counties</i>	Dairy
Mayonnaise	Olive tree	<i>Olive orchard in Tehama and other counties</i>	Oils
Lettuce	Lettuce plant	<i>Lettuce farmer in Monterey, and other counties</i>	Vegetable
Tomato slice	Tomato plant	<i>Tomato farmer in Solano, Yolo, and other counties</i>	Vegetable
Pickle	Cucumber plant	<i>Vegetable farmer in Ventura and other counties</i>	Vegetable
Onion slice	Onion bulb	<i>Vegetable farmer in Riverside and other counties</i>	Vegetable
Apple slices	Apple tree	<i>Apple orchard in El Dorado and other counties</i>	Fruit

Matrix of Standards

Kindergarten

California Standards	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant’s Life	Weather on the Farm	Where Did Your Hamburger Come From?
Common Core English Language Arts								
RI.K.1 Reading Informational Text	With prompting and support, ask and answer questions about key details in a text.	x	x	x	x			
RI.K.7 Reading Informational Text	With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).	x	x	x				x
W.K.2 Writing	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.		x	x		x		x
W.K.5 Writing	With guidance and support from adults, respond to questions and suggestions from peers and add details to strengthen writing as needed.					x		
W.K.8 Writing	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	x	x	x	x	x	x	x
SL.K.1 Speaking and Listening	Participate in collaborative conversation with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.	x	x	x	x	x	x	x
SL.K.5 Speaking and Listening	Add drawings or other visual displays to descriptions as desired to provide additional detail.			x				x

Matrix of Standards

Kindergarten

California Standards	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant's Life	Weather on the Farm	Where Did Your Hamburger Come From?
Next Generation Science Standards								
K-PS3-1 Weather and Climate	Make observations to determine the effect of sunlight on Earth's surface.			x			x	
K-PS3.B Weather and Climate	Conservation of Energy and Energy Transfer. Sunlight warms Earth's surface.			x			x	
K-LS1-1 Interdependent Relationships in Ecosystems	Use observations to describe patterns of what plants and animals (including humans) need to survive.	x		x				
K-LS1.C Organization for Matter and Energy Flow in Organisms	All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.	x		x		x		x
K-ESS2.D Weather and Climate	Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time.						x	
K-ESS3.C Human Impacts	Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.		x		x	x		x
K-ETS1.A Defining Engineering Problems	A situation that people want to change or create can be approached as a problem to be solved through engineering.				x			

Matrix of Standards

First Grade

California Standards	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant's Life	Weather on the Farm	Where Did Your Hamburger Come From?
Common Core English Language Arts								
RI.1.1 Reading Informational Text	With prompting and support, ask and answer questions about key details in a text.	x	x	x				x
RI.1.7 Reading Informational Text	Use the illustrations and details in a text to describe its key ideas.	x	x	x				x
W.1.2 Writing	Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.					x		
W.1.5 Writing	With guidance and support from adults, focus on a topic, respond to questions and suggestions from peers, and add details to strengthen writing as needed.				x			
W.1.8 Writing	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	x	x	x	x	x	x	x
SL.1.1 Speaking and Listening	Participate in collaborative conversation with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.	x	x	x	x	x	x	x
SL.1.5 Speaking and Listening	Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.			x				x
Common Core Mathematics								
1.G.3 Geometry	Partition circles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of.		x					

Matrix of Standards

First Grade

California Standards	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant's Life	Weather on the Farm	Where Did Your Hamburger Come From?
Next Generation Science Standards								
1-PS4.C Information Technologies and Instrumentation	People also use a variety of devices to communicate (send and receive information) over long distances.				x			
1-LS1.A Structure and Function	All organisms have external parts.	x		x		x		

Matrix of Standards

Second Grade

California Standards	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant's Life	Weather on the Farm	Where Did Your Hamburger Come From?
English Language Arts Common Core								
RI.2.1 Reading Informational Text	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.	x	x	x	x			x
RI.2.7 Reading Informational Text	Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text.	x	x	x				x
W.2.2 Writing	Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.					x		
W.2.5 Writing	With guidance and support from adults and peers, focus on a topic and strengthen writing as needed by revising and editing.					x		
W.2.8 Writing	Recall information from experiences or gather information from provided sources to answer a question.	x	x	x	x	x	x	x
SL.2.1 Speaking and Listening	Participate in collaborative conversation with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.	x	x	x	x	x	x	x
SL.2.5 Speaking and Listening	Create audio recordings of stories or poems; add drawings or other visual display to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.			x				
Common Core Mathematics								
2.G.3 Geometry	Partition circles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of.		x					

Matrix of Standards

Second Grade

California Standards	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant's Life	Weather on the Farm	Where Did Your Hamburger Come From?
Next Generation Science Standards								
2-LS2.A Interdependent Relationships in Ecosystems	Plants depend on water and light to grow. Plants depend on animals for pollination or to move their seeds around.	x		x		x		
2-ESS2.C The Roles of Water in Earth's Surface Processes	Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.						x	
2-ETS1.A Defining and Delimiting Engineering Problems	A situation that people want to change or create can be approached as a problem to be solved through engineering.				x			

Matrix of Standards

Third Grade

Standard	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant’s Life	Weather on the Farm	Where Did Your Hamburger Come From?
Common Core English Language Arts								
RI.3.1 Reading Informational Text	By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 2–3 text complexity band independently and proficiently.	x	x	x				
RI.3.7 Reading Informational Text	Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).	x	x	x				x
W.3.2 Writing	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.					x		
W.3.5 Writing	With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.					x		
W.3.8 Writing	Recall information from experiences or gather information from provided sources to answer a question.			x				x
SL.3.1 Speaking and Listening	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others’ ideas and expressing their own clearly.	x	x	x	x	x	x	x
Common Core Mathematics								
3.G.2 Geometry	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.		x					

Matrix of Standards

Third Grade

California Standards	Description	People and Plants Need Nutrients	The Soil We Grow In	Photosynthesis and You	The Sky and the Land	A Plant's Life	Weather on the Farm	Where Did Your Hamburger Come From?
Next Generation Science Standards								
3-ESS2.D Weather and Climate	Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.						x	