California

Agricultural Fact and Activity Sheets

Information compiled by California Foundation for Agriculture in the Classroom

These California-specific fact sheets include information about natural resources or commodity production, history, nutrition, top producing counties, and economic values. The activity sheets provide specific lesson ideas and fun facts for each topic. The lesson plan is aligned to current California Education Standards.

- Agricultural Water
- Alfalfa
- Almonds
- Apples
- Artichokes
- Asparagus
- Avocados
- Beef
- Bees
- Bell Peppers
- Blueberries
- Cantaloupe
- Cherries
- Citrus Fruits
- Cling Peaches
- Corn
- Cotton
- Cut Flowers
- Dairy
- Dry Beans
- Eggs
- Forest Resources
- Fresh Carrots
- Green (Snap) Beans
- Herbs
- Invasive Species
- Lettuce
- Mushrooms
- Pears
- Pickling Cucumbers
- Pistachios
- Plant Nutrients - Nitrogen
- Plant Nutrients - Phosphorus
- Plant Nutrients - Potassium
- Pork
- Poultry
- Processing Tomatoes
- Prunes
- Rice
- Spinach
- Strawberries
- Table Grapes
- Table Olives
- Walnuts

Top 10 Ways to Use Agricultural Fact and Activity Sheets

1. **Ag Literacy Events**
   Information and fun activities for young students who are just starting to learn about agriculture.

2. **Bulletin Board Ideas**
   Assign each student a different commodity or natural resource. Students design a weekly bulletin board and engage their peers in a related activity.

3. **World Geography Connection**
   Where did these California commodities originate? Students create a world map, illustrating country of origins.

4. **History Connection**
   Highlight the dates mentioned on each commodity sheet. Create a timeline that goes all around the classroom, using words and images to record these significant moments in agriculture.

5. **Math Connection**
   Students use numbers found within the facts sheets to create an appropriate graph of their choice. For example, create a pie chart representing the%age of clingstone peaches that are used for fruit cocktail, are canned and are eaten fresh.

6. **Agricultural Marketing**
   Students use the information on fact sheets to develop jingles, billboards, and commercials. Discuss the importance of a strong and positive marketing campaign for agriculture.

7. **Agriscience Project Ideas**
   Fact sheets are a wellspring of ideas for researching and experimenting about different agricultural commodities and natural resources.

8. **Language Arts/English Connection**
   Students read the front of the fact sheet and demonstrate their reading comprehension by writing a summary or writing questions and then exchanging with a partner. Students select an agricultural topic and write a research paper using proper grammar and citing of references.

9. **Nutrition Connection**
   Students analyze the nutritional values of various agricultural commodities and explain the human body's use of specific vitamins. Students identify where the commodities fit in the different food groups.

10. **Add some spice to your lessons!** Find a new method for teaching everything from alfalfa to water.

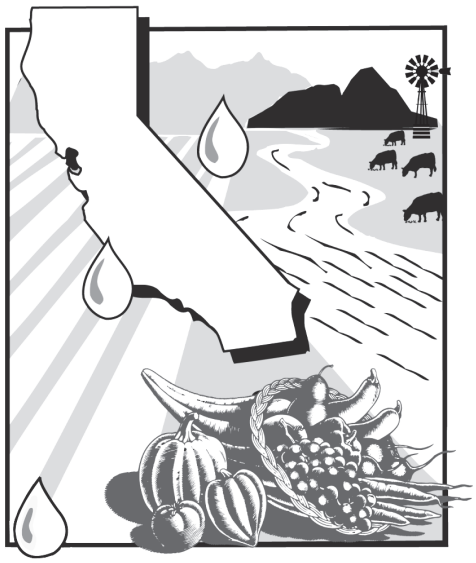
This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (916) 561-5625 • (800) 700-AITC • Fax: (916) 561-5697
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Natural Resource Fact Sheet

Agricultural Water

Information compiled by the California Farm Water Coalition

Sources – California's annual water supply averages about 200 million acre-feet from rain, snowfall and the Colorado and Klamath rivers. The majority is consumed by natural vegetation, leaving approximately 77.2 million acre-feet for dedicated use. An acre-foot is 325,851 gallons and covers an area about the size of a football field one-foot deep. Half of California's water supply is used to protect the environment. Farms account for about 40%, and 10% goes to domestic and industrial water needs in cities and towns.



The major projects that have been the primary sources of stored water include the Central Valley Project (CVP), State Water Project (SWP), Coachella Canal, All-American Canal, and the Klamath Basin. Construction of the CVP began in 1937 and for the SWP in 1957, with full SWP funding approved in 1960. The delivery of water origininating in northern California from the CVP and SWP has been reduced in recent years due to enviromental regulations that govern the delivery of water through the Sacramento-San Joaquin Delta.

Distribution – Water is available through natural precipitation such as rain and snow. It is then transported throughout the state's numerous waterways, including creeks, streams, lakes, and rivers. Other water is stored underground in porous rock and soil (also called aquifers) and brought to the surface by wells and pumps. Approximately 30 to 50 percent of the water supply for farms, homes, and businesses comes from groundwater depending on the water-year type. More groundwater is used during dry years or in times of drought because less surface water is available.

Two-thirds of the demand for water comes from the Southern one-third of the state, while two-thirds of the precipitation and water storage are in the Northern one-third, creating significant challenges for water distribution.

History – The history of California agriculture and water development are intertwined. The first California agricultural water delivery system was built at Mission San Diego Acala. With the Gold Rush, the state's demand for food grew with its population. As early as 1865, private companies began constructing canals in the Central Valley to irrigate crops. In 1877, the State Legislature passed the Wright Act, authorizing the formation of public irrigation districts. These agencies, formed by local citizens, are responsible for providing a steady, reliable supply of water for irrigation, flood control, recreation, human consumption, and other uses. In the twentieth century, the California Department of Water Resources and the United States Bureau of Reclamation also began storing water and delivering it to farms and cities. This large-scale development of water has allowed California to become a national and world leader in agriculture.

Irrigation Techniques – Simply stated, the term "irrigation" is the process of putting water into the soil to make plants grow. There are three basic ways to irrigate: surface, micro-irrigation, and sprinkler. Surface irrigation includes methods such as border-strip and furrow, where water flows on top of the soil. Micro-irrigation techniques, such as drip, bubbler, spray, and subsurface drip, deliver a measured amount of water through an emitter located near each plant. Micro-irrigation techniques can be located above or below ground. Sprinkler irrigation includes the use of a mechanical device which sprinkles water over the crops and simulates rain.

The method of irrigation used depends on many factors including geographical location, crop type, soil type, climate, and economics. Farmers often use laser-leveling of fields, computers, remote sensors, and GPS to improve the efficient use of their water supplies.

Economic Value – Water is an essential component to life and the economy of California. It is vital to the success of California's $50 billion agricultural industry. California farms grow two-thirds of the fruit, one-third of the vegetables, and almost one out of every five gallons of milk produced in the United States. Each of the more than 400 commodities grown in California depends upon the availability of water—from the fruits, vegetables and meats people eat, to the cotton and wool clothing people wear, and the forest and floral products people use and enjoy.

For additional information:
California Farm Water Coalition
(916) 391-5030
Website: www.farmwater.org

California Farm Water Coalition

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Agricultural Water Activity Sheet

History of Agricultural Water Development in California

Late 1700s - California missions began to irrigate crops for their own consumption. Cattle production dominates commercial agriculture.

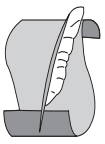
1839 - John Sutter founds New Helvetia (later to become Sacramento) as the first large-scale agricultural operation in the Sacramento Valley.

1848 - James Marshall discovers gold in the American River.

1856 - First commercially developed irrigation project is constructed in Yolo County.

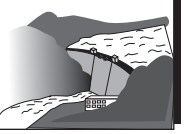
1879 - The California State Supreme Court case Lux vs. Haggin establishes "The California Doctrine" of water rights.

1887 - With the Wright Act, the State Legislature allows the establishment of public irrigation districts. Shortly thereafter, the Turlock, Modesto, and Merced Irrigation Districts are formed.

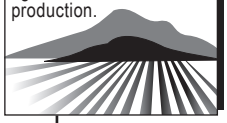


1901 - Colorado River water is first used to irrigate crops in the Imperial Valley.

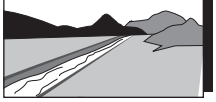
1940s - First deliveries of irrigation water made by the federally funded Central Valley Project.



1946-Present - California leads the nation in agricultural production.



1960s - First deliveries made by the California State Water Project.



2015 - Exports of California farm products to other countries exceed $21 billion in value.

Lesson Ideas

- Examine the affect of watering duration and frequency on plant growth by manipulating one variable. Beginning with the same amount of water, irrigate one plant with more water less often and one plant with less water more often.
- Fill three plastic cups; one with soil, one with gravel, and one with sand. Predict which cup will hold the most water. Pour water into the cups to test your predictions.
- Discuss the water cycle and how evaporation, condensation, transpiration, and precipitation affect agriculture.
- Place a rain gauge outside your classroom and record the precipitation in your area.
- Research the seasonal rainfall averages in your area.
- Locate newspaper articles that cover local, state, and federal water issues. Discuss how they affect the students.

Fantastic Facts

1. Most precipitation in California occurs in Northern California.
2. California's agriculture industry is dependent on the availability of water.
3. The average annual rainfall and snowfall in California is 194.7 million acre-feet.
4. Irrigation is the process of putting water in the soil to make plants grow.
5. Rivers, creeks, dams, canals, and pumps are used to store and transport water.
6. The first water delivery system established for California agriculture was the Mission San Diego Acala.
7. Lasers are used to level irrigated fields with precision.

Lesson Plan: Waterways

Introduction: Surface, sprinkler, and micro-irrigation are the three main types of irrigation techniques used in California. In this lesson, students will deliver water from a source (a bucket) to a field (an aluminum pie plate) and apply the water using an irrigation technique.

Objective: Students will learn about sources of water in their community and construct a model of a chosen irrigation technique.

California Standards: CC ELA: SL.3-12.4, SL.4-8.5; NGSS: 3-5-ETS1-1, 3-5-ETS1-2, 5-ESS3-1, MS-ETS1-3, HS-ETS1-1, HS-ESS3-1

Materials: Buckets, aluminum pie plates, straws, duct tape, sponges, old rags, PVC pipe tubing and fittings, writing paper, butcher paper, markers, and other supplies.

Procedure:

1. Divide students into groups. Have them discuss and write down where they think the water for their community comes from. Discuss their thoughts and clarify the information with facts you have gathered from your local water agencies.
2. Explain that once water is available, it must be delivered to cities and farmlands. Show the students the supplies they have to work with—the bucket of water is the source and the straws, sponges, pipe fittings, etc. are the equipment used to deliver the water to the farm or city (the aluminum pie plate placed a reasonable distance from the souce).
3. Once the students have created a way to transport the water, add soil, which represents the farm or garden that needs irrigating, to the pie plate. Have the students devise a way to efficiently irrigate their crop.
4. After completing the experiment, have each group draw a picture of their model on butcher paper and share their successes and challenges with the class. Compare and contrast the various delivery and irrigation techniques.
5. Invite a local water district representative or a farmer to visit your class to discuss how local water is delivered to homes and farms and how the farms are irrigated.

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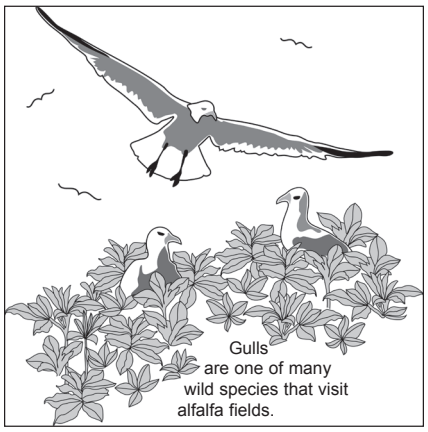
Commodity Fact Sheet

Alfalfa

Information compiled by the California Alfalfa and Forage Association

How Produced – Alfalfa is a perennial crop, which means it will grow for several years after planting. Alfalfa is planted in the spring or fall. Since the seeds are small (1-2 millimeters), they must be planted close to the surface of the soil. Between 15 and 25 pounds of seeds are planted per acre, which is about the size of a football field. After sprouting, the seedlings are relatively weak and must be protected from weeds. However, after developing a "crown," the swollen top of the root, alfalfa plants are vigorous and can re-grow many times after the tops are cut for hay, between 3 and 12 times per year, depending on the area. Roots can grow deeper than 15 feet but are typically 3-5 feet deep. The purple alfalfa flowers are pollinated by bees, whose hives are placed next to fields that are used for alfalfa seed production.



Gulls are one of many wild species that visit alfalfa fields.

Varieties – Many alfalfa varieties are available to growers. Those that tolerate freezing are grown in the northern United States and Canada. Other varieties continue to grow during the winter months in areas such as Southern California and Arizona where growers may harvest 12 months of the year. Alfalfa breeders have developed many varieties of alfalfa that are highly resistant to diseases and insect pests, thereby reducing the need for pesticides.

Commodity Value – Among crops grown in the United States, alfalfa is ranked third in value, after corn and soybeans. This doesn't include the value of the livestock, which rely on alfalfa for feed. In California, alfalfa is planted on more than 500,000 acres.

Alfalfa is harvested with a swather, which cuts off the crop a few inches above the ground and places it in strips three to five feet wide where it dries in the sun. When the cut alfalfa is dry enough, the hay is raked and a baler machine is used to gather it up and compress it into a bale. Bales range in weight from 50 pounds to one ton and can be the shape of small rectangles or round bundles. Large square or round bales are moved by tractors or “squeezes,” which are forklifts made specifically for hay. The hay-making process is highly mechanized, and most hay goes from field to barn without being touched by human hands.

Alfalfa can also be made into silage by harvesting the forage and storing it in a silo while it is still moist, where it is preserved in a process called fermentation. Alfalfa is sometimes grazed by sheep and cattle, which means the animals eat it while it is growing in the field. Other times alfalfa is made into small cubes or pellets for easy storage and delivery.

History – Remains of alfalfa more than 6,000 years old were found in Iran. The oldest writings about alfalfa are from Turkey, dating 1300 B.C. Alfalfa was important to the early Babylonian cultures, and to the Persians, Greeks, and Romans because of its importance for feeding horses used in war.

The eastern United States' colonists, including Thomas Jefferson and George Washington, grew alfalfa on a few acres. However, it was not widely grown in this country until the California Gold Rush of 1849. From California, alfalfa spread eastward to Nevada, Utah, Kansas, and Nebraska. Today, alfalfa is grown on over 17 million acres from coast to coast and is the nation’s fourth largest acreage crop.

Alfalfa is an important rotation crop as it adds nitrogen to soil and improves soil structure for future crops. Nodules on alfalfa roots contain bacteria that take nitrogen gas from the air and convert it into nitrogen plants can use. This process is called nitrogen fixation. The financial value of this soil improvement is significant. Crops grown in rotation with alfalfa can save most if not all nitrogen fertilizer applications, and the soil health after growing alfalfa is significantly better. Wildlife, including more than 130 bird species, use alfalfa fields for food and shelter.

Top Producing Counties – The leading counties in California are Imperial, Riverside, Siskiyou, and Modoc. Imperial accounted for 21.5 percent of the total value, followed by Riverside at 10.5 percent.

Nutritional Value – Alfalfa is considered the premier forage of dairy cows. It produces very high protein and energy. Thus, much of the milk, yogurt, cheese, cream, dried milk, and ice cream we eat are produced from alfalfa. Dairy cows today are capable of producing approximately 10 gallons of milk per day, and these cows need the nutrition that high quality alfalfa hay provides. A modern alfalfa field can produce 2,400 gallons of milk per acre.

For additional information:
California Alfalfa and Forage Association(916) 441-1064
calhay.org

CAFA
CALIFORNIA ALFALFA & FORAGE ASSOCIATION

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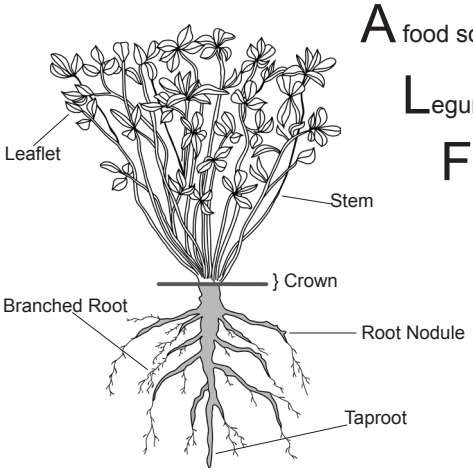
Alfalfa Activity Sheet

The Benefits of . . .



A food source for dairy cows, beef cattle, sheep, horses and zoo animals.

Legumes such as alfalfa convert atmospheric nitrogen into forms that plants can use.

Facilitates soil conservation by reducing soil erosion.

A wildlife habitat for hundreds of animals, including some endangered species.

Lots of open space is created, which provides beauty.

Flowers on the plant make alfalfa honey, the main honey crop in the U.S.

A habitat for more than 1,000 diverse species of insects, spiders, and mites.

Lesson Ideas

- Investigate the root depth of alfalfa and other crops. Create a pictogram to compare different crops.
- Research the symbiotic relationship that exists between the bacterium Rhizobium and the roots of legumes such as alfalfa. Discuss the importance of symbiosis in biology using other examples from nature.
- Why is alfalfa such an important wildlife habitat? Discuss 'food webs' and the relationship between primary producers (alfalfa) and insects & herbivors & wildlife that occur there. Visit the California Alfalfa and Forage Association website (www.calhay.org). Read "Alfalfa, Wildlife and the Environment" and discuss.
- Determine the acres of lawn at your school. If those lawns were planted with alfalfa, how much nitrogen would be fixed annually if each acre produced 500 pounds of nitrogen from nitrogen fixation? If nitrogen was worth $1 per pound as fertilizer, what would be the value added to your school?

Fantastic Facts

1. Dairy cows eat alfalfa, which gives them the energy and protein to produce milk products.
2. Alfalfa was domesticated 6,000 years ago.
3. George Washington was the first U.S. president to grow alfalfa.
4. Approximately 200,000 alfalfa seeds are in one pound.
5. Alfalfa roots can penetrate the soil more than 15 feet deep.
6. People eat alfalfa in the form of alfalfa sprouts or in the form of ice cream and cheese.
7. Honey is often made by bees after they visit alfalfa fields.
8. Alfalfa can be cut between 3-12 times and can last up to 25 years in the field.
9. More than 130 different bird species are known to visit alfalfa fields.

Lesson Plan: It All Began with Alfalfa!

Introduction: Alfalfa contributes to a wide range of nutritious foods that we enjoy every day. Alfalfa is fed to dairy cows and beef cattle. Much of the honey in the U.S. comes from alfalfa flowers.

Objectives: Students will analyze the ingredients of different foods and determine their relationship to alfalfa.

California Standards: CC ELA: SL.3-12.4; CC Math: 3.MD.3, 6.SP.5b; NGSS: 5-PS3-1

Materials: Obtain the following from a school lunchroom, grocery store or restaurant: cheeseburger, ice cream with chocolate syrup and whipped cream, beef taco with cheese and sour cream, chocolate milk, bread slice with butter and honey, pepperoni and cheese pizza, and a bowl of nutritious cereal with milk.

Procedure:

1. Create seven stations. Display one of the menu items and accompanying food containers at each station.
2. Divide the students into seven small groups and assign each group to a station.
3. Ask the students to closely examine the items, discuss the origin of each food, estimate how many different components began with alfalfa, and name other plants and animals that contributed to the food. They should write down their thoughts.
4. After a few minutes, have the groups rotate to another station and repeat the procedure. Continue until each group has visited all of the stations.
5. Have a representative of each group report their findings. Discuss concepts that may have been overlooked.
6. Create a bar graph that displays each menu item and the number of ingredients that could have originated from alfalfa.
7. Poll the class to determine which food item is most popular. Create a bar graph that depicts the popularity of the food items. Compare the two graphs. Are there any relationships that can be determined? Discuss the impact alfalfa has on the lives of students.

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Commodity Fact Sheet

Almonds

Information compiled by the Almond Board of California

How Produced – Following the winter dormant season, early spring weather coaxes the first almond blossoms from their buds. Because the trees are not self-pollinating, at least two varieties of almond trees are planted in alternate rows in each orchard. Almonds grow best when the weather from February onward is frost-free, has mild temperatures, and minimal rain so blossoms can flourish and bees can cross-pollinate the blossoms. After the petals have dropped and the trees have leafed out, the first signs of the fuzzy gray-green fruit appear. The hulls that cover the growing almonds continue to harden and mature. In July, the hulls begin to split open. Between mid-August and late October, the splits widen, exposing the shells, which allow the almond kernels to dry. The whole nuts eventually separate from their stems and the hulls open completely.

Before harvest, orchard floors are swept and cleared. Mechanical tree shakers knock the almonds to the ground, where they are allowed to dry before they are swept into rows and picked up by machine. They are transported to carts and towed to the huller, where the hull is removed.

The almonds are packaged raw, roasted, or flavored. Some varieties are prepared into various forms including sliced, diced, slivered, ground (almond flour), blanched, and made into pastes and butters.

History – Almonds are mentioned far back in history, even in the Bible. They were a prized ingredient in breads served to Egyptian pharaohs. The ancestry of the almond is unknown, but almonds are thought to have originated in the Mediterranean area of Europe. Explorers ate almonds while traveling the Silk Road between the Mediterranean, Central Asia, and Eastern Asia. Before long, almond trees were being enjoyed by many different cultures, from China to India and beyond.

The almond tree was brought to California from Spain in the mid-1700s by Franciscan Padres. However, the moist, cool weather of the coastal missions did not provide optimum growing conditions. It was not until the following century that trees were successfully planted inland. By the 1870s, research and cross-breeding had developed several prominent almond varieties. By the turn of the twentieth century, almonds were firmly established in the Sacramento and San Joaquin areas of California's Central Valley.

Varieties – Almond growers have sought to produce delicious varieties that would be hardy in the fields and work well as a cooking ingredient. Research in the 1870s resulted in some of today's varieties including Mission, Price, Carmel, and today's most popular, the Nonpareil. Since then, more than 40 varieties have been developed and grown commercially. Most research today focuses on developing varieties that are more resistant to crop damaging insects. Almonds are related to the peach and rose families. In fact, most almond trees are grafted to peach rootstock, which is more resistant to pests.

Commodity Value – California produces the largest supply of almonds in the world. With more than 7,600 growers and 100 almond processors, California produces approximately 80% of the world's almonds and 100% of the United States' commercial supply. The United States is the largest consumer of almonds. India is the largest importer of California almonds importing more than 362 million pounds in 2020-21. More than 90 countries import California almonds, including India, Spain, China, Germany, United Arab Emirates, Italy, the Netherlands, Japan, South Korea, and Turkey.

Top Producing Counties – The largest almond-growing region of the world is California's Central Valley, an area stretching nearly 500 miles. Its hot, dry summers and cool, wet winters make it an ideal location for growing almonds. Top producing counties include Kern, Fresno, Stanislaus, Merced, and Madera.

Nutritional Value – Almonds are an excellent source of vitamin E and magnesium. Studies have shown that almonds can actually lower cholesterol levels. A handful (one ounce, about 23 almonds) has the same amount of calcium as one-quarter cup of milk and the same amount of fiber as an apple or orange. Almonds are also a good source of protein and are listed in the "meat, eggs, poultry, fish, dry beans, and nuts" category of MyPlate which recommends that most nine to 18-year-olds should eat five-to six-ounce equivalents from this category each day.

For additional information:
Almond Board of California
(209) 549-8262
Website: www.Almonds.com

california almonds®

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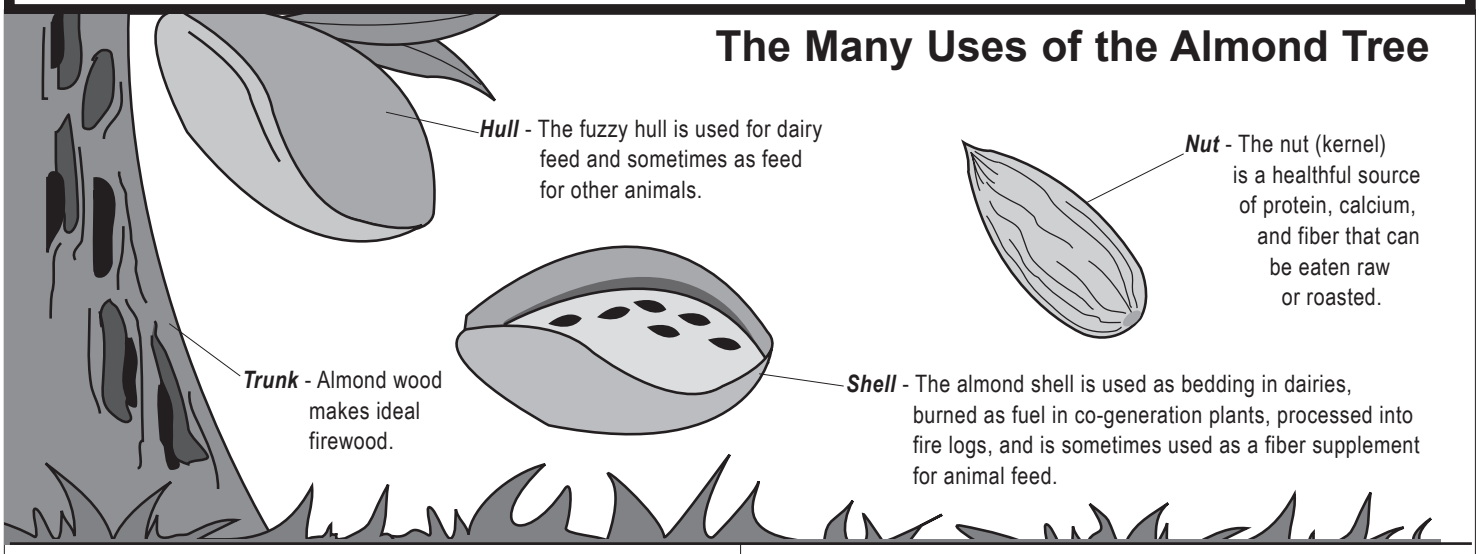
Almond Activity Sheet

The Many Uses of the Almond Tree



Lesson Ideas

- Visit your local market and see how many different almond products you can find.
- Examine the nutritional labels for almonds and milk. Create a graph comparing the nutritional value of the two. Remember to use equivalent serving sizes.
- Investigate which countries import California almonds. Identify the locations on a map and illustrate the flow of goods.
- Taste test a variety of almonds including raw, roasted unsalted, and roasted with salt, or other flavors.
- Study the process of cross-pollination and learn how it is used in the almond industry.
- Create a mural or book about the life cycle of an almond tree.
- Create recipes using almonds. Make a class "Almond Cookbook."
- Study the scientific processes involved in the blanching (removing the skin) of almonds.

Fantastic Facts

1. Peaches and roses are related to the almond.
2. Dairy feed is one use of the fuzzy almond hull.
3. Almond trees did not become a staple tree at California missions because the coastal climate was too mild for optimal production.
4. A mechanical shaker removes almonds from trees.
5. At least two varieties of almond trees are planted in almond orchards because almonds must cross pollinate.
6. Non-pareil is the most popular variety of California almond.
7. Almonds have calcium that is important for strong bones and teeth.
8. California produces 100 percent of United States almonds.

Lesson Plan: A Look at the Nutrients of an Almond

Introduction: Almonds contain five of the six classes of required nutrients—carbohydrates, fats, protein, fiber, vitamins, and minerals. Your students will examine the nutrition information of whole-shelled almonds and learn about the nutrients they provide to the human body.

Objective: To study the role nutrients play in growth.

California Standards: CC ELA: RI.3-5.3, W.3-12.7, RST.6-12.1; NGSS: 3-LS1-1, 5-PS3-2; MS-LS1-7; HS-LS1

Materials: One pound package of whole uncooked almonds with nutrition label, one almond in shell for each student, construction paper, markers, nutrition reference books or encyclopedias.

Procedure:

1. Distribute one almond with a shell and one almond without a shell to each student. Have students make observations about the shell and discuss its uses. Have students compare their two almonds. Are they the same varieties or do they appear different? Discuss the varieties of almonds, their uses, and the cross-pollination needed to produce almonds.
2. Have each student observe the nutrition label for one serving of almonds.
3. Assign each pair of students nutrient found in almonds and research the human body's need for that particular nutrient.
4. Create a class book showing how these nutrients assist the human body to grow, repair, furnish energy, and regulate body processes. Incorporate artistic techniques, word processing, use of the Internet, library research, and group problem solving.

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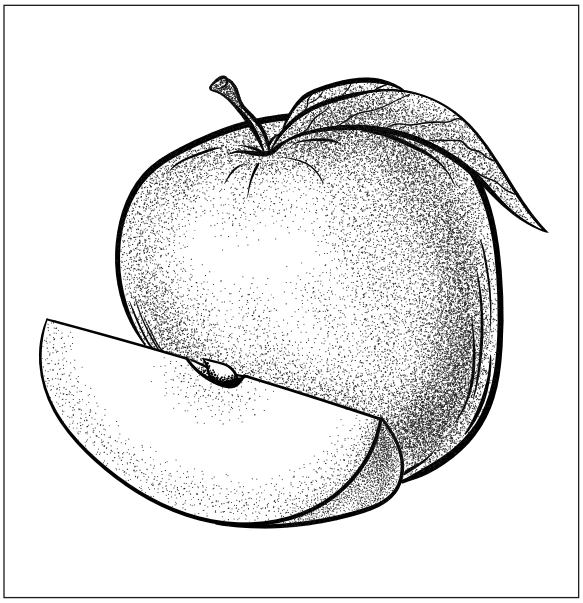
This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Apples

Information compiled by the California Foundation for Agriculture in the Classroom

How Produced – Grafting, a horticultural technique that joins two plant structures together, is the first step in apple production to ensure that rootstock and varieties will bare fruit. Once planted, it takes four to five years for the tree to produce the first fruit and will produce fruit for up to 100 years. Most apple varieties are self-sterile, meaning they are unable to pollinate themselves and thus rely upon cross-pollination. The most commonly used pollinator is crab apples (also known as wild apples) in which pollination takes place in the spring, when trees are in blossom. Once pollinated, blossoms fall to the ground and small apples begin to grow in the blossom's place.



During spring and summer, apple trees require frequent watering. Apple trees can tolerate a great deal of heat if they have sufficient water. The apple crop is harvested by hand in the fall. To insure crop production for the following year, trees must be pruned yearly in the winter to promote new vegetative growth.

History – The first documented history of apples dates back to 300 B.C. in the Persian Empire, where the cultivation and enjoyment of apples was an essential part of civilized life. In the 1400s apples were rediscovered and in the 1500s regained popularity again as a common commodity. During this time, European settlers of the Americas brought with them their English custom varieties, and the first apple orchard was planted in America. William Blackstone was the first pilgrim to plant apples trees grown in the United States in the Massachusetts Bay Colony in 1629.

In the early 1800s, stories began circulating about John Chapman, better known as Johnny Appleseed, who traveled across the Ohio Valley carrying bags of apple seeds. Venturing westward, he planted seeds and grew apple trees wherever he roamed to ensure that settlers living in the western frontier would have nutritious apples to eat. Apples have a place in more recent history, too. In 1962, the first American to orbit the Earth carried pureed applesauce to consume during the flight.

Varieties – The apple, scientifically known as Malus domestica, is a member of the rose family. California has almost 13,000 acres dedicated exclusively to apple production. California grows four main varieties: Gala, Fuji, Granny Smith, and Cripps Pink. Within the United States, roughly 2,500 varieties of apples are grown. The top 10 apple varieties grown within the United States are Red Delicious, Golden Delicious, Fuji, Granny Smith, Rome Beauty, McIntosh, Idared, Jonathan, Gala, and York Imperial.

Commodity Value – The United States' 7,500 apple producers grow approximately 240 million bushels of apples each year on 322 thousand total acres of land. The wholesale value of the United States apple crop is approximately $4 billion annually. Worldwide, the United States ranks second to China in apple production. California ranks fourth in U.S. apple production, generating 12% of the national apple crop which is approximately 1.5 to 2.5 million (40lb.) boxes of apples per year. Seventy-five percent of the apples produced in California will be shipped domestically and 10% to 15% are exported. Canada, Malaysia, Mexico, Taiwan, and Panama are five of the 27 global destinations California exports to.

Top Producing Counties – The major apple production areas are in the San Joaquin Valley with San Joaquin, Fresno, and Madera counties being the leading producers. Historically, apple production was limited to the coastal mountains, the Sierra foothills, and in the Southern California mountains. Recently apple production has expanded into the Central Valley with new plantings of Granny Smith, Fuji, Gala, and other varieties. Coastal apple producing counties, like Sonoma, Santa Cruz, and San Luis Obispo, primarily produce apples for juicing.

Nutritional Value – One medium-sized apple provides 20% (five grams) of the daily requirement for dietary fiber, 8% of the daily requirement for vitamin C, and is a healthy source of potassium. One apple has approximately 80 calories and contains no fat, cholesterol, or sodium.

For additional information:
California Apple Commission
Phone: (559) 225-3000
Website: calapple.org

CALIFORNIA APPLE COMMISSION

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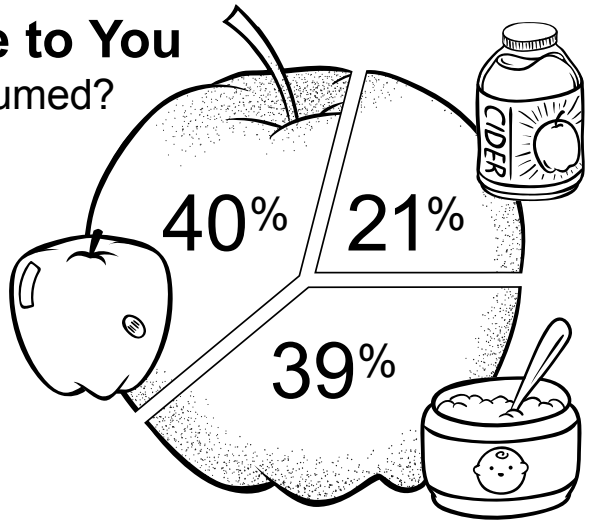
Apples Activity Sheet

From Apple Tree to You

How are apples consumed?



Fresh market

Apple juice and cider

Processed into dried fruit, baby food, and other products

Lesson Ideas

- Dissect and examine the anatomical parts of an apple. Observe and identify the function of each structure.
- Research and explain the aphorism “an apple a day keeps the doctor away” using nutritional information.
- Observe and practice various grafting techniques used to grow apples.
- Compare hand and machine harvesting methods. Invent a harvesting machine for apples.
- Perform experiments that show the different methods of preserving apples.
- Research and determine what the top ten apple varieties are and why they are most popular amongst consumers.
- Calculate the percentage of water weight in apples by dehydrating the fruit.
- Sprout an apple plant from a seed.

Fantastic Facts

1. The crabapple is the only apple native to North America.
2. Apples are propagated by two methods: grafting or budding.
3. The apple variety “Red Delicious” is the most commonly grown apple variety worldwide.
4. Apples are a member of the rose family.
5. Twenty-five percent of an apple’s volume is air, which makes it naturally buoyant.
6. It takes the energy from 50 leaves to produce one apple.
7. World’s top apple producers are China, United States, Turkey, Poland, and Italy.
8. Archeologists have found evidence that humans have been enjoying apples since 6500 B.C.
9. Apples account for 50% of the world’s deciduous fruit tree production.
10. Two-thirds of an apple’s fiber and antioxidants are found in the skin.

Lesson Plan: Sugar or Starch

Introduction: Apples naturally contain starch also known as carbohydrates. When an apple begins its ripening process, starches are converted into sugar. This conversion process starts at the core of the apple and moves outward toward the skin. To check the ripeness of the apple an iodine test can be used to identify the amount of starch present.

Objective: Students will investigate the ripening process of apples by conducting an iodine experiment.

Standards: NGSS: 4-LS1-2, 3-5-ETS1-3; CC ELA: L.W.4-5.7

Materials: Variety of apples, iodine tincture, nitrile gloves, safety goggles, paintbrush, knife, paper plates or towels

Procedure:

1. Safety note: Iodine tincture is a hazardous material and should be handled with care. Wash hands after use and avoid contact with the eyes and skin.
2. Place individual, whole apples on labeled plates (1, 2, 3, 4, etc.) and instruct students to observe each apple’s size, color, texture, and firmness. Have students hypothesize, based on their previous knowledge, which apples are at peak ripeness.
3. Cut apples in half, displaying both sides of the apples on each labeled plate. Have students observe each apple’s internal characteristics.
4. With the paintbrush, evenly apply iodine across the cut surface of each top apple half. Let the apple sit for two minutes. Leave the other apple half untouched as a control to compare changes in each apple.
5. Observe the surfaces of the apples. Large amount of purple indicates high starch/low sugar. Little to no purple indicates low starch/high sugar.
6. Place apples on a continuum from least to most ripe. Make concluding observations.
7. Write a conclusion paragraph on your experimental findings.

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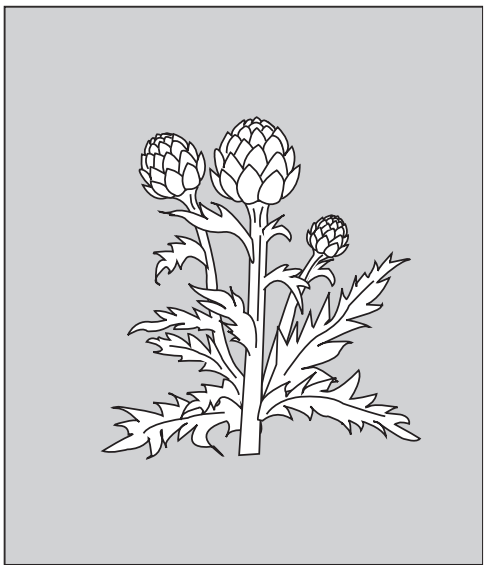
Commodity Fact Sheet

Artichokes

Information compiled by the California Artichoke Advisory Board

How Produced – The artichoke is a member of the thistle tribe of plants in the sunflower (Compositae) family. The vegetable we eat is the immature flower heads of the artichoke plant.



Many artichokes are grown along the central coast of California, which provides the ideal climate for artichoke flowers to mature slowly. Historically, artichokes were grown as perennial plants, which means artichokes could be harvested year after year from the same plant. Only a few hundred acres of perennial artichokes still exist today.

In California, most artichokes are planted annually. Many artichoke plants are grown in nurseries from seed. In the spring, small artichoke plants are transplanted in the field. These fields are cultivated and irrigated until artichokes are ready to harvest six months later. By planting annually, growers can rotate their crops with other crops like cauliflower and lettuce—reducing pest pressures and costs, while increasing yields.

Artichokes are an extremely labor-intensive crop with labor representing 40 to 60 percent of the growing costs. Artichokes are harvested entirely by hand. The same artichoke field will be harvested every seven days and even more often during summer and early fall. Artichokes are sorted and packed in the field, by hand, into waxed cartons and immediately trucked to cooling facilities where they are refrigerated to 34 degrees Fahrenheit and 98% humidity.

Varieties – Several varieties are grown in California today, but most of the artichokes grown are proprietary hybrid varieties that do well in specific harvest windows. Varieties are classified as thorned to semi-thorned to thornless. The different varieties can be grown in different parts of California, targeting particular harvest windows.

Although not a different variety, "Frost-Kissed" artichokes caused by winter frosts (temperature dropping below 32 degrees) are available in stores for a limited time. Frost causes the outer layer of the artichoke to turn brown, flake and peel, much like a sunburn. Many believe frost enhances the flavor of the artichoke resulting in a nutty taste.

Commodity Value – California produces virtually 100% of the nation's supply of fresh artichokes. The artichoke industry provides hundreds of jobs and annually contributes more than $78 million to the state's economy. The 2021-2022 crop year produced more than 3,417,048 cartons of artichokes, averaging 22 pounds each, on 4,175 acres statewide.

Top Producing Counties – The artichoke was named the official vegetable of California and is also the official vegetable of Monterey County where approximately 68% of the state's artichokes are grown. In 2021, artichokes ranked 16th in crop value for this agriculturally rich area and the 2021 crop was valued at $43,018,000. Other top producing counties include Riverside, Santa Barbara, Santa Cruz, San Mateo, and Ventura.

History – Artichokes were cultivated in the Mediterranean basin thousands of years ago. Theophrastus, an Ancient Greek philosopher and naturalist (317 B.C. – 287 B.C.), wrote of them being grown in Italy and Sicily. During the late nineteenth century, California's first commercial artichoke fields were planted by Italian immigrants south of San Francisco near Half Moon Bay. The modern artichoke industry started during the 1920s in Castroville, California. Today, Castroville is the self-proclaimed "Artichoke Center of the World."

Nutritional Value – One 12-ounce artichoke contains 25 calories, is low in sodium, and contains no fat or cholesterol. One medium artichoke is an excellent source of fiber and vitamin C, and a good source of folate and magnesium. Artichokes also contain phytochemicals, antioxidants in the flavonoid family, which are beneficial in the prevention of certain cancers and boosting the body's immunity. Recent research shows cooked artichokes are a good source of antioxidants. Health professionals recommend a low-fat diet with at least five servings of fruits and vegetables each day to reduce the risk of heart disease, diabetes, and obesity.

For additional information:
California Artichoke Advisory Board
(831) 633-4411
Website: www.artichokes.org

CALIFORNIA ARTICHOKE ADVISORY BOARD

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Artichoke Activity Sheet

#1

Growers plant transplants into the ground, cover them with soil and water them.

#2

After about six months artichoke flower buds are ready for harvest. The largest buds form close to the tops of the stalks.

#3

Artichokes, harvested by hand using small knives, are tossed into packs on the backs of the field workers.

#4

When the packs are full, the artichokes are transferred to bins or directly to field packing machines.

#5

Artichokes are sorted and packed by hand into waxed cartons and refrigerated immediately.

#6

Artichokes are purchased by consumers and can be a nutritious low-fat component of daily meals.

Lesson Ideas

- Using the data provided under "Commodity Value," calculate the total weight of artichokes produced annually and determine the yield (in pounds) per acre.
- Brainstorm a list of careers related to this industry.
- Create a picture book showing the cultivation and harvest methods of artichokes.
- Cook and serve artichokes as a snack. Serve with low-fat dips your students create.
- Find out why vitamin C, magnesium, and folate are important in one's diet.
- Research the climate in your county and determine what variety of artichoke, if any, would best grow in your community.
- Dissect an artichoke and label its parts.
- Research the vegetative propagation methods of artichokes. Find out what other plants are propagated in this way.
- Analyze the geometric arrangement of artichoke leaves on the flower.

Fantastic Facts

1. California produces virtually 100% of the nation's commercial artichoke crop.
2. Annual artichoke plants generally stay in the field for less than a year.
3. Artichokes can be a part of a healthy diet because they are low in fat and cholesterol, contain fiber, vitamin C, and other minerals. They also contain phytochemicals.
4. Artichokes are harvested by hand.
5. Labor is the most expensive part of growing artichokes.
6. Not only is the Artichoke Monterey County's official vegetable, it was also declared California's official vegetable on April 10, 2013 by then Lieutenant Governor, Gavin Newsom.
7. Italian immigrants began the commercial production of artichokes in California.
8. Artichoke production is labor intensive because of hand-picking and hand-packing.

Lesson Plan: Let's Advertise!

Introduction: Many methods are used to promote and advertise products to consumers. This activity encourages students to explore the various persuasion techniques used by advertisers as they develop a commercial for artichokes, artichoke dips, or artichoke utensils.

Objective: Students will research advertising methods in order to design a commercial advertising California artichokes.

California Standards: CC ELA: SL.3-12.1, SL.3-12.4, SL.3-12.5, W.3-8.1, W.3-6.7

Materials: Resource materials on various advertising techniques, butcher paper, markers, and other supplies needed to create student-designed props, video camera with tripod.

Procedure:

1. Research and discuss various methods of advertising used to persuade a consumer to purchase a product. Classify the commercials according to type (TV, internet, print, radio, etc).
2. Brainstorm a list of various food commercials that students feel are successful in their advertising. Discuss why the commercials are successful.
3. Divide students into groups. Have each group decide what they will advertise: artichokes, dip, or utensil.
4. Have each group create a 15 to 20 second commercial. They must determine what type of commercial they are producing, write a script, design a slogan and/or logo, and prepare any props they will need for the commercial.
5. Assign a filming date and time for each group—30 minutes filming time for each group is appropriate. After taping, share the video-taped commercials with the class. Determine the type of commercial each group created and vote on which commercial would be most effective.

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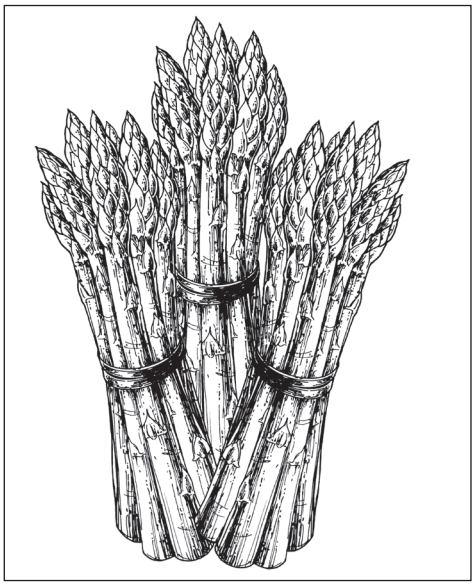
Commodity Fact Sheet

Asparagus

Information compiled by the California Asparagus Commission

How Produced – Asparagus is the growing shoot of a perennial plant raised in furrowed fields. Commercial plantings take two or more years to grow from seed to crowns. As the crowns grow, they develop buds that push up as asparagus spears every spring. The number of buds on a crown increases each year of production. A typical commercial crown is harvested for 10 to 15 years.



Individual spears with compact, tight heads, and vivid green color are harvested when they are about nine inches long. Each day, workers walk the furrows selecting choice spears and cut them by hand. An individual crown produces different sized spears. Earlier in the season, the plants produce thicker spears, which are the most tender.

While the harvest season lasts only 60 to 90 days in each production area, California's wide range of microclimates allows for fresh asparagus to be available from January through May with a small amount in September and October.

The asparagus is graded and packed in sheds located near the fields to assure maximum freshness. Spears are typically bundled into one-pound bunches, containing 10 to 12 spears, and placed into 30-pound crates specially designed for safe transport. A moist, absorbent fiber pad is placed at the bottom of the crates to prevent drying. Space is left at the top to allow for elongation of spears, which continue to grow. The boxed asparagus is rapidly cooled to a temperature of 34°F to 37°F. Careful handling at every stage of transit is the key to retaining superior flavor, texture, and nutritional content.

History – Asparagus is a member of the lily family (Liliaceae). Its name comes from the Greek language meaning "sprout" or “shoot." Cultivation began more than 2,000 years ago in the eastern Mediterranean. Ancient Greeks and Romans prized asparagus for its unique flavor, texture, and medicinal qualities. It was eaten fresh when in season and dried for winter use.

In the sixteenth century, asparagus gained popularity in France and England. From there, the early colonists brought it to America. Asparagus was first planted in California during the 1850s in the San Joaquin Delta. In addition to the Delta, today's production is centered in the Central Coast, Southern California desert, and Central Valley.

Varieties – Asparagus is available in a variety of sizes; however, size has no bearing on flavor, texture or tenderness. Today, 98% of California's asparagus production is marketed as a fresh green product with the remaining 2% used for processing.

The most common variety is University of California 157 (UC157), which is adapted for warm temperatures and moist soils. Other green-colored varieties include Brock and Ida Lea. The University of California has developed a new variety, UC115, which will soon be in commercial production. It has a longer green stock and tighter tip than current, commercial varieties. Asparagus is also available in white and purple. White asparagus, which grows from the same crown as green asparagus, is shielded from the sun by straw or dirt to prevent the plant from developing chlorophyll, a photosynthetic green substance. Purple Passion produces purple spears which turn green when cooked.

Commodity Value – California produces a majority of the nation’s supply of fresh, green asparagus. The value of this California crop has declined because of increased foreign competition.

Top Producing Counties – Asparagus producing counties include Monterey, Fresno, Contra Costa, and San Joaquin.

Nutritional Value – Asparagus is low in calories, contains no sodium or fat, and is an excellent source of potassium, folic acid, and dietary fiber. One five-spear serving contains 20 calories and two grams of protein. Asparagus contains antioxidants which are beneficial in the prevention of certain cancers and is a significant source of vitamin C, vitamin B_6 and thiamin.

For additional information:
California Asparagus Commission
(916) 690-3911
Website: www.calasparagus.org

California Asparagus Commission

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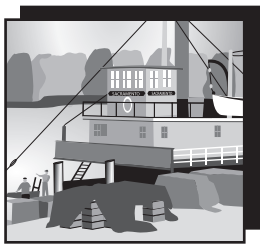
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Asparagus Activity Sheet

History of California Asparagus Production

➤ #1

1850s-Migrant families started growing asparagus in the Stockton/Sacramento Delta. Harvested by hand, farmers also used horse and plow to work the fields.



➤ #2

1930s-Asparagus was taken to the docks by truck and then loaded on to ferries where they found their way to San Francisco or Sacramento—the product was then loaded on to railcars and shipped by rail all over the U.S.

➤ #3

1950s-Farmers began producing more green than white asparagus because consumers liked it more. Both were usually processed in cans.

➤ #4

1970s-Another change in consumer preferences led the industry to produce and ship fresh asparagus to grocery stores rather than a canned or frozen product. This change resulted in the need for faster transport to the marketplace. Farmers began to use semi-trucks and airplanes to get their product to market.
1980s-Asparagus was first shipped in refrigerated containers aboard airplanes to destinations all over the world.

➤ #5

Today-Fresh asparagus is still harvested and packed all by hand—just as it was 150 years ago. But, today's asparagus farmer uses tractors rather than horses and ships fresh green asparagus to consumers all over the world.

Lesson Ideas

- Asparagus is measured one inch above the bottom of the stem. Using various sizes of asparagus, determine the circumference, radius, and diameter at this point.
- Bring in a unique asparagus recipe to share. Convert the ingredient measurements in order to provide enough servings to feed the whole class.
- Place cut asparagus spears, tulips, and daffodils in a glass of water. Calculate any growth that occurs.
- Calculate the number of standard crates needed by a grocer who wants to stock 200 lbs. of asparagus.
- On a map, locate California's primary asparagus production regions.

Fantastic Facts

1. The lily, a type of flower, is related to the asparagus plant.
2. Asparagus contains protein, potassium, fiber, vitamin C, vitamin B6, and antioxidants.
3. There are 10 to 12 spears in a typical one-pound bunch of asparagus.
4. White asparagus is green asparagus that has not been exposed to the sun.
5. Asparagus is harvested by hand.
6. Labor accounts for 75% of the cost of growing asparagus.
7. Asparagus can continue to grow after it is cut.

Lesson Plan: Asparagus! It's All About Teamwork!

Introduction: It is important to understand that both cooperation and competition are valuable yet challenging components of the business world. This is especially true in asparagus production. More than 75% of asparagus production costs are associated with labor including planting, harvesting, packaging, and shipping. Additionally, in recent years the value of California asparagus production has declined due to international competition in places where labor costs are lower.

Objective: Students will plan, perform, and compare methods for harvesting asparagus in this classroom simulation.

California Standards: NGSS: 3-5-ETS1-1, 3-5-ETS1-2, MS-ETS1-1, MS-ETS1-2, HS-ETS1-3

Materials: Green construction paper, scissors, shoe boxes, rubber bands.

Procedure:

1. Divide the students into teams of five or six students.
2. Designate one area "the field" where you place 10 sheets of green construction paper and two pairs of scissors for each group.
3. Designate another area, at least 25 feet away, as "the end of the field row." Place 20 rubber bands and a shoe box at this end for each group.
4. Explain that the green construction paper represents asparagus growing in a field. They are to cut 1-inch strips of paper, get it to the end of the row, bundle it into bunches of 10 with a rubber band, and then neatly place it in a packing crate (the shoe box). The first team to do this is the winner.
5. Model the activity and then have the students perform the activity several times, making changes as needed to become more efficient. Discuss potential impacts on people and the environment that might limit possible solutions. After clean-up, discuss how cooperation and competition were involved in the activity. Was competition a useful tool? How about cooperation? How did competition and cooperation affect quality?

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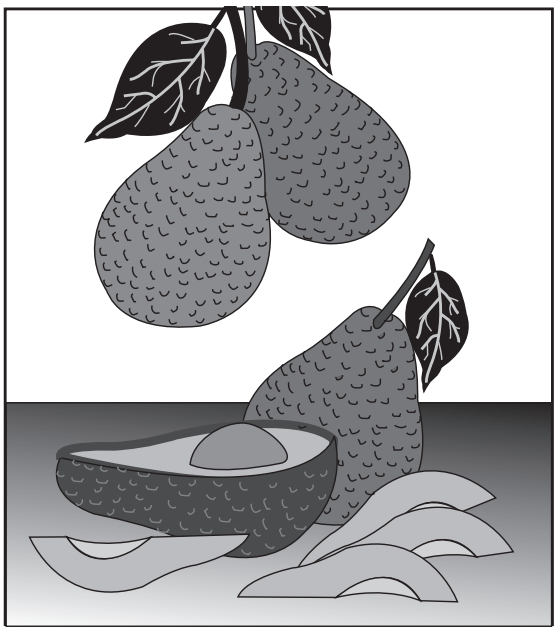
Commodity Fact Sheet

Avocados

Information compiled by the California Avocado Commission

How Produced – California's coastal microclimates are ideal for growing avocados. California avocados are grown by about 3,000 farmers on approximately 50,000 acres. A single California Avocado tree can produce 200-300 avocados a year. However, the average tree usually produces approximately 150 avocados. The fruit is harvested from each tree by hand using avocado clippers. On tall trees, ladders up to 30-feet high and poles up to 14-feet long are used to reach the fruit.



The fruit is then carefully placed into large picking bins, which hold 900 pounds of fruit, and transferred to a main road where large "boom" trucks pick up the fruit and haul it to a local packinghouse. Upon arrival, the avocados are immediately put into a large cold storage room for 24 hours to remove field heat and preserve quality. The fruit is then placed onto conveyor belts for grading and sorting. The avocados are brushed, inspected for quality, and placed into single-layered cartons called flats or double-layered cartons called lugs. Lugs have a consistent weight of 25 pounds. Avocado size classifications are based on how many can fit into one lug. The fruit is shipped in refrigerated trucks to markets across the nation, with the majority of the crop going to California and other western states. A small amount of the crop is exported. Most California avocados are sold fresh.

Varieties – Hass avocados account for nearly 95% of California's avocado crop volume. They have thick pebbly skin that generally turns purplish-black during ripening. They are available in peak volume from spring through summer. Lamb Hass and GEM are Hass-like varieties that are generally available May through September. Other commercially produced varieties include Fuerte, Zutano, Bacon, Pinkerton, Reed and Gwen. These "greenskin" varieties yield to gentle pressure when ripe and are available at different times throughout the year.

Commodity Value – California production averages 300 million pounds each year. Crop value has averaged over $350 million with some years topping $400 million.

Top-Producing Counties – Avocados mostly grow on the coastal strip between Monterey Bay and California's southern-most border. These areas are ideal due to the rich soils and mild climates. Approximately 29% of California Avocados are produced in San Diego County and 42% in Ventura County.

History – The avocado (Persea americana) originated in south-central Mexico, sometime between 7000 and 5000 B.C. But it was several millennia before this wild variety was cultivated. Archaeologists in Peru have found domesticated avocado seeds buried with Incan mummies dating back to 750 B.C. and there is evidence that avocados were cultivated in Mexico as early as 500 B.C. Spanish conquistadors loved the fruit but couldn't pronounce it and changed the Aztec word to a more manageable aguacate, which eventually became avocado in English. The first English-language mention of avocado was by Sir Henry Sloane in 1696.

In 1871, Judge R.B. Ord of Santa Barbara introduced avocados to the U.S. with trees from Mexico. By the early 1900s, growers were seeing the avocado's commercial potential and ever since have been hunting for improved varieties. By the 1950s around 25 different varieties of avocados were being commercially packed and shipped in California, with Fuerte accounting for more than two-thirds of the production. Even though Hass was discovered in the 1920s and patented by Rudolph Hass in 1935, it was not until large-scale industry expansion occurred in the late 1970s that Hass replaced Fuerte as the leading California variety.

Nutritional Value – California avocados are a heart-healthy superfood that provide "good" fats to one's diet. Naturally sodium-, cholesterol-, and sugar-free, one-third of a medium avocado (50 g) has 80 calories and contributes nearly 20 vitamins and minerals, making it a nutrient-dense choice. Avocados also are a good source of fiber and folate.

For additional information:
California Avocado Commission

(949) 341-1955
Website: CaliforniaAvocado.com

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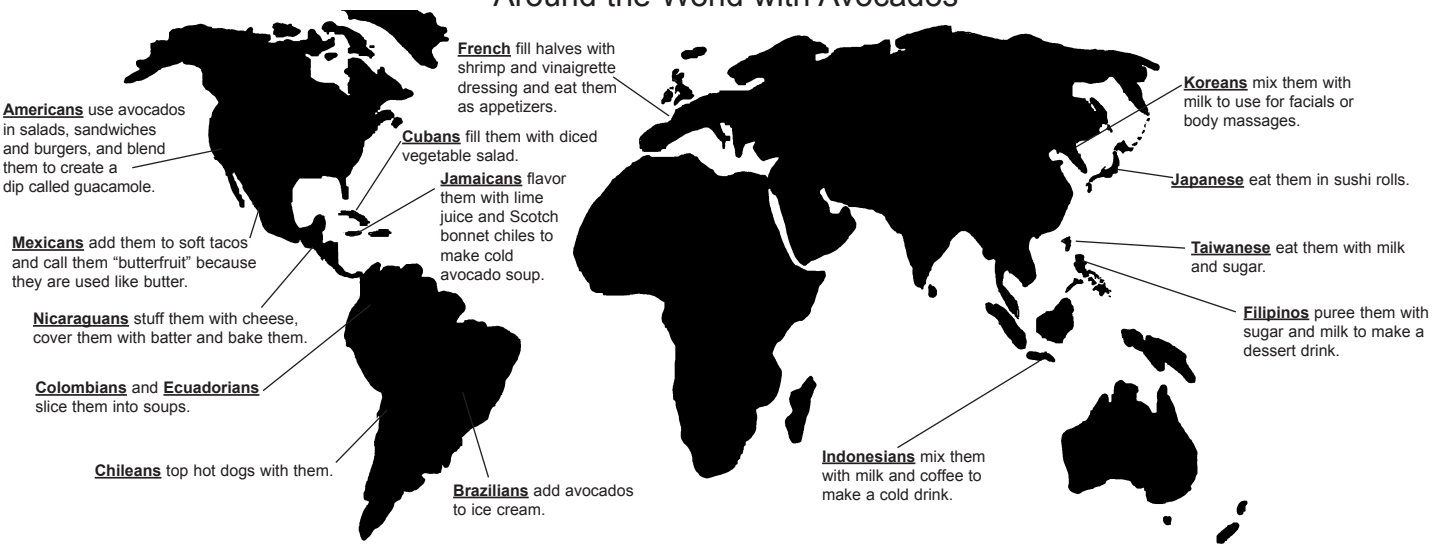
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Avocado Activity Sheet

Around the World with Avocados



Lesson Ideas

- Use craft materials to create individual packaging for safe avocado transport. Test your invention by transporting your avocado (via backpack) for several days. Compare your results with others.
- Research which beauty products contain avocados and develop an infomercial to promote an avocado-based product.
- On a California county map, shade in the top-producing counties which produce avocados.
- Make a picture book illustrating the harvesting of avocados.
- Cut open an avocado seed. Identify the embryo, cotyledons, and seed coat. Draw a cross-sectional view.
- Record and graph the weekly/monthly prices of avocados.
- Sprout an avocado plant from a seed.
- Cut an avocado in half and remove the fruit and seed. Weigh the skin, meat, and seed in grams. What percent of the avocado is edible?
- If a lug of size 48 avocados weighs 25 pounds, how much does one average avocado of this size weigh?

Fantastic Facts

1. Avocados are a fruit.
2. The Hass variety accounts for 95% of California's crop.
3. San Diego and Ventura county are the top producing counties.
4. Fuerte, Zutano, Bacon, Pinkerton, Reed, and Gwen varieties all have green skin.
5. Avocados are harvested by hand using special shears called clippers.
6. Avocados are a heart-healthy superfood.
7. Avocados are naturally sodium-, cholesterol-, and sugar-free.
8. The Hass avocado is named after Rudolf Hass, a postal worker who discovered it in La Habra Heights, California.

Lesson Plan: Ripening an Avocado

Introduction: Avocados are increasingly shipped ripe and ready-to-eat to retailers and foodservice operators. Some are shipped "firm" and arrive at the point-of-purchase unripened. Ethylene is a natural hormone emitted from fruit such as avocados, bananas, kiwifruit, and apples that causes the unripe fruit to ripen.

Objective: Students will investigate different methods to speed the ripening process of avocados.

California Standards: NGSS: 3-5-ETS1-1, 3-5-ETS1-2, MS-ETS1-1, MS-ETS1-2, MS-PS1-2; CC ELA: SL. 3-12.4

Materials: At least two avocados per group, bananas, apples, kiwifruit, paper bags, plastic bags, and other supplies determined by the students, knife.

Procedure:

1. Explain to the students why many fruits, including avocados, are shipped unripe.
2. Divide the students into groups and have them design an experiment that would expedite the ripening process of avocados. Show them supplies such as bananas, kiwifruit, apples, paper bags, plastic bags, and other items available.
3. Have each group obtain your approval of their experimental design, conduct the experiment and complete a formal laboratory report.
4. At the completion of all of the experiments, have the students share their results with the class. This can be done while the class eats an avocado snack.
5. Discuss the various methods that are used to commercially ripen fruit such as avocados.

07/22 Learn About Ag

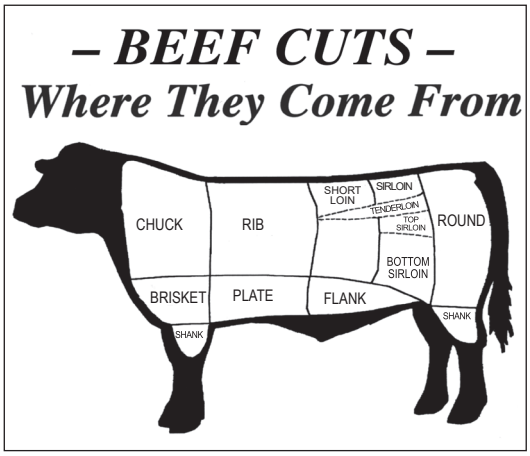
This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Beef

Information compiled by the California Beef Council

How Produced – There are approximately 670,000 beef cattle on about 11,000 ranches in California. In addition, there are 1.72 million dairy cows, which also play an important role in the state's beef industry. Cattle are ruminants, which means they have a four-chambered stomach. Most beef cattle in California graze on land that cannot be used for raising other crops. There are four types of cattle operations; cow-calf, seed stock, stocker, and feedlot. Many producers have a combination of these operations.



Cow-calf producers make up the largest segment of California cattle operations. These ranchers have a herd of breeding cows, replacement heifers (young cows), and bulls. The cows are bred to calve in the spring or fall. Calves are usually sold after they are weaned, at about seven months. After weaning, cattle are sent to feedlots for approximately 120 days where they are fed a high-energy ration of grain and hay. Nineteen percent of cropland in the nation is used to raise feed grains for livestock. Cattle are good recyclers and are often fed agricultural by-products such as almond hulls or rice straw.

Once cattle weigh approximately 1,200 to 1,400 pounds, they are processed. Ninety-eight percent of each animal is used, but less than half is eaten as beef. Cattle provide a multitude of by-products that consumers use every day, including photographic film, soap, tires, leather, and pharmaceuticals.

Breeds – There are 275 recognized breeds of cattle throughout the world. Most breeds in California originated from Europe or have a Brahman influence. Brahman cattle from India are known for their tolerance to heat.

Cattle brought to the Western Hemisphere by the early Spanish explorers were the ancestors of the Texas Longhorns. While extremely hardy, these cattle did not produce a palatable product. As a result, nineteenth century cattle producers imported purebred cattle, including European Angus and Hereford, to improve the quality of their herds. During the twentieth century, breeds such as Charolais, Limousin, and Gelbvieh became more prevalent due to their leaner meat characteristics.

Commodity Value – The sale of cattle and calves accounted for $195.8 billion in cash receipts in 2021 and was fourth in terms of value in the state's top 10 commodities in 2021. Nationally, California ranks fourth in total cattle numbers behind Texas, Nebraska, and Kansas. Beef and beef products are in the top 10 of California exports, bringing in $413 million in 2020.

Top Producing Counties – Beef cattle are raised in every county in California except San Francisco. Top beef cattle producing counties include Tulare, Kern, Merced, and Imperial.

History – The introduction of cattle to North America mirrors the exploration and settlement of the continent by Europeans. Columbus introduced cattle to the Western Hemisphere on his second voyage to the New World in 1493. Spanish explorer Hernando Cortez took offspring of those same cattle to Mexico in 1519. In 1773, Juan Bautista de Anza brought 200 head of cattle to California to supply the early California missions.

The hide and tallow trade sustained the California economy while it was still under Mexican rule and hides were used as currency to buy supplies from Boston trading ships. When James Marshall discovered gold in 1848, the beef business boomed, feeding the fortune seekers who came to the gold fields. Many of the miners soon realized there was more money to be made in cattle than in prospecting.

Nutritional Value – Beef is a nutritionally dense, high-quality protein. One three-ounce cooked serving of lean beef provides 10 essential nutrients and about half your Daily Value of protein. Beef is an excellent source of zinc, selenium, niacin, vitamin B12, and vitamin B6, and a great source of phosphorous, iron, choline, and riboflavin. There are more lean cuts available today than ever before. More than 60 percent of beef cuts found in a supermarket are considered lean by the U.S. Department of Agriculture (USDA) standards. Beef is also a primary source of monounsaturated fat in diets which is the same type of healthy fat found in avocados and olive oil.

For additional information:
California Beef Council
(916) 925-BEEF
Website: www.calbeef.org

CALIFORNIA BEEF COUNCIL

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Beef Activity Sheet

Cattle are ruminants.
Ruminants are unique because they have four-chambered stomachs.

1) Cattle chew food in their mouth.

2) After the food is swallowed, it travels down the esophagus to the rumen.

3) In the rumen, the largest chamber of the stomach, the food mixes and softens with the aid of microorganisms.

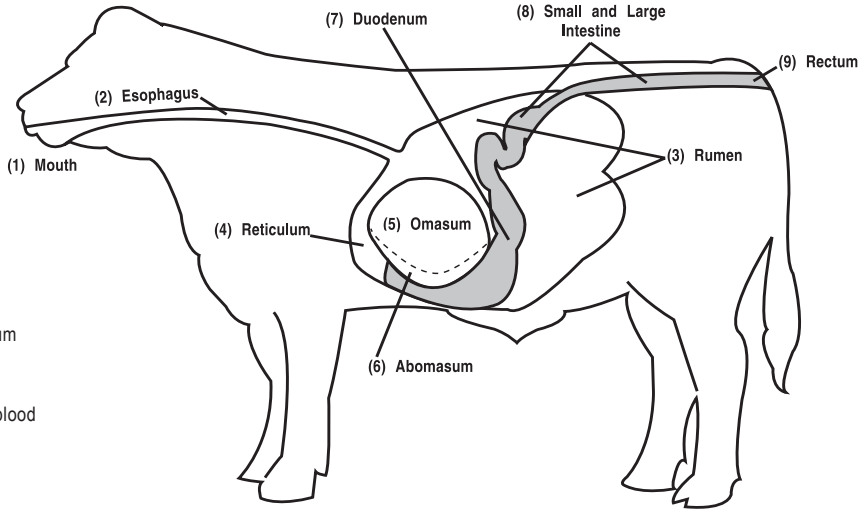
4) Food travels from the rumen to the reticulum where further digestion occurs. Large food items are returned to the mouth for further chewing. This food is called cud.

5) When the food particles are small enough, they pass through the omasum where water is removed.

6) The food travels to another stomach chamber called the abomasum where stomach juices continue to digest the food.

7-8) From the abomasum, food moves through the duodenum and the small and large intestines where nutrients are absorbed into the blood stream and utilized by the animal.

9) Waste products are excreted through the rectum as manure.



Lesson Ideas

- Use a Venn diagram to compare and contrast monogastric and ruminant animals. How does their digestive system affect their nutritional needs?
- Given cattle weight at the time of processing, how many pounds of the animal is used? How many pounds are eaten as beef?
- Create a timeline depicting significant events within the beef cattle industry.
- Research the following breeds of cattle and locate their place of origin on a world map: Angus, Brahman, Charolais, Gelbvieh, Hereford, Limousin, Maine-Anjou, Nellore, Santa Gertrudis, and Shorthorn.

Fantastic Facts

1. Cattle have a four-chambered stomach.
2. 98% of beef cattle is used with less than half eaten as beef.
3. Hide, tallow, fat, and bones are examples of beef by-products that are used to make a wide variety of products.
4. People originally raised cattle for their hides and tallow.
5. The most popular form of beef served is ground beef.
6. Iron and zinc are examples of minerals in beef that are readily used by the human body.
7. The five most popular sports in the United States depend on by-products from cattle: Baseball, football, basketball, soccer, and volleyball.

Lesson Plan: From Sun to Steak

Introduction: Cattle, ruminant animals, are able to digest plant cellulose—a substance indigestible by humans. This unique characteristic of ruminant animals assists in converting energy into forms that can be used by other animals including humans. Beef and dairy products result from the ruminant digestive process. In this activity the students will create a mural which depicts the energy flow from the sun to food people eat.

Objective: Students will create an energy flow mural depicting the steps from sun to decomposers.

California Standards: CC ELA: SL.3-7.2, RST.6-10.7
NGSS: 4-LS1-1, 5-PS3-1, 5-LS2-1, MS-LS1-6, MS-LS2-3

Materials: Butcher paper, dictionary, glue sticks, index cards, lengths of yarn in a variety of colors, markers.

Procedure:

1. Have students find the definition for “ruminants” and list a variety of animals that fit into this category.
2. Discuss how students will create a mural showing the energy flow from the sun to the food people eat.
3. Divide students into pairs or trios. Distribute one of the listed phrases to each group:
   - cattle and sheep
   - plants get their energy from sun, water, and air
   - grazing animals live on land not suitable for crops
   - people eat fruits, vegetables, meat, dairy products, and grains
   - crops grow on fertile land
   - ruminant animals have a unique digestive tract
   - food from farms is processed, packaged, and sent to stores
   - bacteria, earthworms, and snails are types of decomposers
4. Have students draw a scenic background for their mural made of butcher paper. There should be hills, valleys, waterways, and an urban city with stores and houses.
5. As a class, decide which phrase fits into which part of the mural. Have students create and add a scene that shows what their card indicates. Incorporate key sentences into the mural.

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Commodity Fact Sheet

Bees

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – Honey bees are raised by beekeepers but also live in the wild. Each colony consists of the queen, male drones, and thousands of female worker bees. Bee colonies have a seasonal cycle that repeats each year. Worker bees and the queen live in colonies and spend the winter eating stored honey. When the weather gets warmer and spring flowers bloom, the bees become more active. In the Spring, thousands of worker bees emerge after metamorphosis from eggs laid by the queen. Worker bees leave the hive to collect pollen and nectar. A bee colony is especially active in the summer as bees forage. In the fall, honey bees reduce or cease their foraging because there are fewer blossoms and flowers. The bees work on storing the pollen and nectar in cells in the hive. Honey bees are the most important pollinating insect because they can be managed and transported to crops requiring pollination. As honey bees gather pollen and nectar for food, they pollinate crops which is essential for food production.

Beekeepers move and manage hives. Well-managed hives may need additional room in the summer, and beekeepers add box-like sections on top of the hive. Each box holds 8-10 wooden frames with sheets of wax foundation where the bees build their hexagonal wax cells for storing pollen and nectar. Pollination services are the primary function and income of most California beekeepers' hives, and beekeeping is a critical part of today's agricultural market.

History – Botanist C.A. Shelton introduced honeybees to California in 1853. Transporting the first colonies of bees to America was challenging. The sea voyage from England lasted six to eight weeks, and the bees were confined, which is hard on bee colonies. Many of the first attempts to bring bees were unsuccessful. Bees arrived from the East Coast by ships that traveled through the Panama Canal, then north to the West Coast. Today's honey bees came to the United States from Western Europe in 1622 and to California approximately 200 years later.

Varieties – There are about 4,000 species of bees. Wild bee species live in the ground or trees, and honey bees usually live in bee hives. California bees include bumblebees, carpenter bees, digger bees, and most familiar to humans, honey bees. Honey production in California ranked third in the U.S. in 2021 at 9,570,000 pounds with a value of $23 million.

Commodity Value – According to USDA, honey bees are responsible for pollinating $15 billion worth of crops. Honey bees pollinate both large commercial crops and backyard gardens. Bees pollinate apples, cherries, peaches, prunes, pears, and many other fruits. They also pollinate crops like cilantro, onions, and alfalfa seed. About one-third of the human diet comes from insect-pollinated plants, and honey bees are responsible for 80% of this pollination.

Top Producing Counties – Bees are raised by commercial operations and hobby beekeepers throughout California. Large beekeeping operations, primarily in Northern California counties, produce the majority of queen bees and packaged bees, sold primarily to the Midwest. Major metropolitan areas like the Bay Area, San Diego, and Los Angeles have many hobby beekeepers whose hives play an important role in pollinating urban parks and gardens.

Nutritional Value – Honey bees collect nectar and pollen, which they consume for energy. Nectar is also converted to honey and stored in the hive to be consumed later. Honey can provide energy for humans. Honey contains carbohydrates and is prized for its natural sweetness. It is the only sweetener that also contains B vitamins, minerals, and protein.

For additional information:
California State Beekeepers Association
(916) 441-0302
Website: californiastatebeekeepers.com

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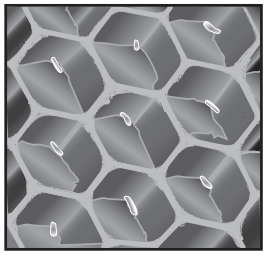
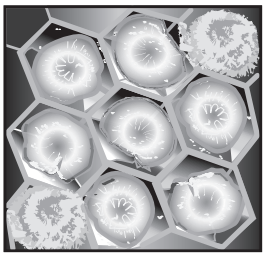
Bee Activity Sheet



1

The queen bee lays one egg in each cell.



2

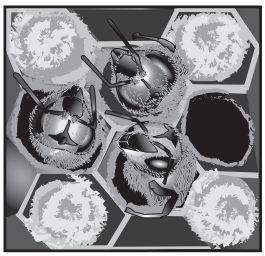
After three days, eggs hatch into larvae.

3

After about six days, the eggs are capped and each larva spins itself a cocoon and becomes a pupa.

4

Another ten days later, an adult worker bee emerges.

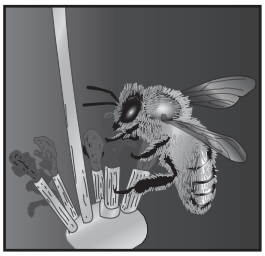


5

After the new adult comes out, she spends her time with jobs in the hive. This includes cleaning hive cells, feeding the developing larvae, capping the cells with wax, and guarding the front entrance.

6

After about three weeks in the hive, each worker bee leaves her job in the hive to go out and collect food for the colony.



Lesson Ideas

- Research the history of bees and honey, write a report and give an oral presentation.
- Research Colony Collapse Disorder. Create a poster that explains the problem and offers possible solutions.
- Bees build honeycomb made of hexagonal wax cells. Build an art piece using geometric.
- Do a taste test of honey from different regions and bees that pollinated different crops.
- Research the connection between bear population and beekeepers. Report to your class.
- Come up with a recipe using honey and share with your class.
- Study pollinators. Create a pollinator book that includes drawings and facts.

Fantastic Facts

1. A ¼ cup of bees is about 200 bees.
2. Bees have specific jobs. Some collect pollen and others collect nectar.
3. Bees can only sting once and then they die.
4. Bees are insects with three body parts and six legs.
5. People who are allergic to bees may need to have an EpiPen injection used to assist against anaphylactic shock. It does not cure the reaction but provides time allowing the victim to get to the nearest hospital.
6. Most beekeepers in the United States manage European honey bees.
7. Bears do love honey and will raid apiaries.

Lesson Plan: Bee Hive Shapes (all about polygons)

Introduction: Each cell in the honeycomb is in the shape of a hexagon. Hexagons are one of the few regular polygons that can fit together perfectly without leaving any gaps. Repeating a shape to cover a surface without any gaps or overlaps is called tessellation. This activity will allow students to explore what shapes create tessellations.

Objective: Students will study geometric figures in nature and create tessellation art displays.

California Standards: CC Math: 4.G.2, 5.MD.5, 5.G.4, 6.G.2, 7.G.6, 8.G.2, 3, 4, HS.G-CO.5; NGSS: 3-5-ETS1-1; Visual Arts Content: Grades 4-12, 1.0 Artistic Perception

Materials: Polygon stencils, notebooks, plain paper, pencils, colored pencils or markers

Procedure:

1. Show the class a picture of honeycomb to demonstrate how the hexagonal shapes fit together perfectly. Define the word tessellation and how honeycomb is an example of this.
2. Explain to the class that they will be looking for other geometrical shapes that can tessellate like the hexagon. Students can write a prediction in their notebooks of one or two shapes they think will fit together and why.
3. Give students time to find other polygons that can fit together without gaps or overlaps. Students will use stencils to draw one shape repeatedly to find this out. This can be done independently or in groups.
4. Discuss as a class what the students discovered. Students look back at their predictions and see if they were correct. Older students can discuss which shape is best for beehives and why, including which shape provides the most volume to store honey.
5. Conclude the lesson by allowing students to create and color their own repeating shapes. Display their tessellation art.

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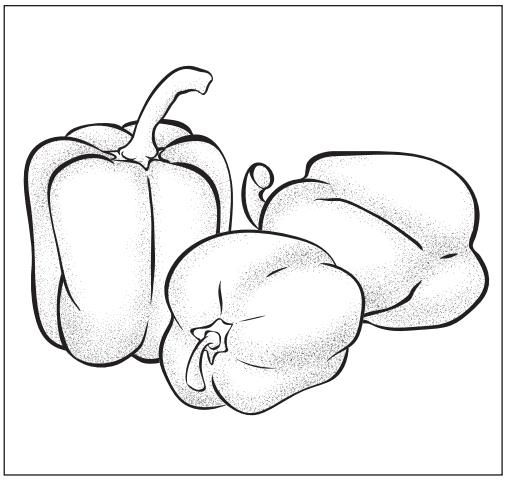
Commodity Fact Sheet

Bell Peppers

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – The pepper plant is a member of the *Solanaceae* or nightshade family, which also includes tomatoes and potatoes. Pepper plants are planted in the field as seeds or as young plants, called transplants. Bell peppers are warm-season crops, sensitive to freezing temperatures at any growth stage. The ideal growing temperature is between 75° and 85°F, with night temperatures between 55° to 65°F. If planting seeds directly into the ground, the producer typically sows seeds March through May. If planting by transplant, plants are grown in greenhouses for two months before being transplanted out in the field from March through July.



Bell peppers are a slow-growing crop, with up to 180 days until the final harvest. Due to their slow-growing nature, they face greater exposure to elements such as inclement weather, pests, and weeds. Therefore, bell pepper fields require significant input costs such as water, labor, and crop protection. Bell peppers are also susceptible to sunscald, which occurs when ripening fruit is not adequately shaded by leaf cover. Adequate fertilization to increase canopy coverage helps control this problem. The color of bell peppers change as they ripen on the plant. Most bell peppers are primarily sold as green peppers, but red, yellow, orange, purple, and black colors will show as the plants ripen. Peppers are ready for harvest between early July and October. Fresh market peppers are harvested by hand, with multiple harvests occurring within a single season. Peppers intended for processing are often harvested mechanically. In this process, each plant is cut at the base and peppers are shaken from the plants. The shaken peppers are hand-sorted on the machine. Conveyor belts transfer the peppers into produce bins pulled by a tractor following alongside.

The bins are transferred onto flatbed trucks using a forklift. Trucks haul processing peppers to a facility where they are peeled, sliced, or diced into the familiar frozen, canned, or dehydrated pepper products seen on store shelves. Fresh market peppers are graded and packed in sheds located near the fields to assure maximum freshness.

History – About 9,000 years ago, the wild pepper plant originated near Bolivia and Peru. It was later cultivated for its fruits by the Olmecs, Toltecs, and Aztecs. The seeds spread throughout Central America by both nature (wind, animals) and human activity (migration, exploration).

Bell peppers were carried throughout the world by Spanish and Portuguese explorers. The misleading name "pepper" was given by Europeans when Christopher Columbus brought the plant back to Europe. Due to the versatility of the bell pepper, it quickly became a staple in diets throughout the world including Central Europe where they were dried and ground to make paprika. Commercial bell peppers were first grown in the United States in the early 1920s.

Varieties – Varieties are selected on the basis of yield potential, quality, market acceptability, and disease resistance or tolerance. There are nearly 200 different varieties of bell peppers grown throughout California for both fresh market and processing. These include varieties with the traditional multi-lobe shape as well as longer more pointed varieties. Common bell pepper varieties used for commercial production include: Huntington, Classic, and Baron.

Commodity Value – California leads the nation in pepper production, accounting for 34% of the nation's total. In 2020, California's pepper growers grew approximately 16,500 acres, producing 341,000 tons of peppers valued more than $194 million. Canada is the top export market, valued at $26 million.

Top Producing Counties – Riverside is the top producing county in California generating nearly $79 million. The second highest producing counties are Ventura and Kern, both generating $42 million.

Nutritional Value – One serving of red bell peppers is an excellent source of vitamin A and vitamin C and a good source of vitamin B6. Vitamin B6 helps the body break down or metabolize protein, aids in the formation of red blood cells, and helps maintain normal brain function. Bell peppers are also an excellent source of dietary fiber and provide small amounts of several other vitamins and minerals.

For additional information:
California Pepper Commission
(559) 591-3925
Website: www.calpeppers.com

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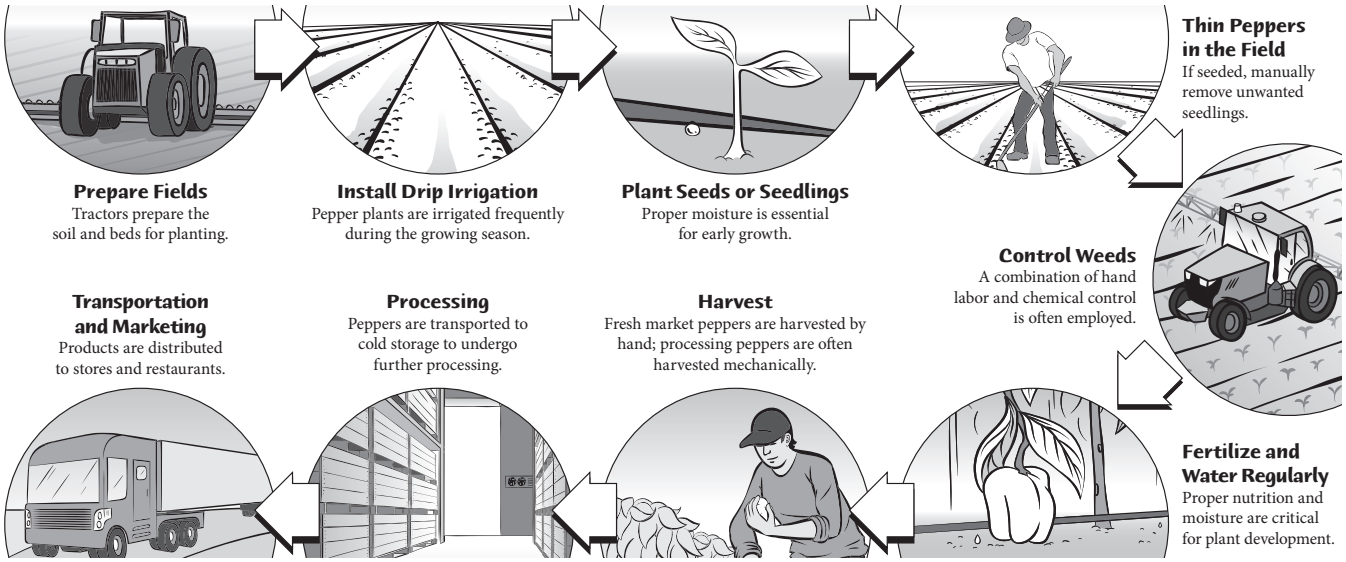
Bell Peppers Activity Sheet



Prepare Fields
Tractors prepare the soil and beds for planting.

Install Drip Irrigation
Pepper plants are irrigated frequently during the growing season.

Plant Seeds or Seedlings
Proper moisture is essential for early growth.

Thin Peppers in the Field
If seeded, manually remove unwanted seedlings.

Control Weeds
A combination of hand labor and chemical control is often employed.

Fertilize and Water Regularly
Proper nutrition and moisture are critical for plant development.

Harvest
Fresh market peppers are harvested by hand; processing peppers are often harvested mechanically.

Processing
Peppers are transported to cold storage to undergo further processing.

Transportation and Marketing
Products are distributed to stores and restaurants.

Lesson Ideas

- Research preserved peppers throughout history and plot significant dates on a timeline.
- Study the anatomy of the bell pepper. Label the different parts.
- Examine the capsicum genus and compare the different species of peppers.
- Create an alliterative phrase about peppers. Try to say it three times fast.
- Compare the edible mass of a traditional bell pepper and a sweet mini pepper.
- Explore different types of preserved peppers and compare price per ounce.
- Identify cultures that use peppers in cooking and locate them on a map.
- Research the Scoville rating for a variety of peppers, make a bar graph to illustrate.

Fantastic Facts

1. Peppers are fruits because they are produced from a flowering plant and contain seeds.
2. Columbus and Spanish explorers named bell peppers while searching for peppercorn plants to make black pepper.
3. Bell peppers are called by different names throughout the world (US: bell pepper; England: pepper; Japanese: papurika; Australia: capsicum)
4. Red bell peppers have twice the vitamin C content as green bell peppers.
5. Bell peppers are the only member of the pepper family to not contain capsaicin, the main compound that gives chili peppers their heat.
6. Green bell peppers are less sweet and almost bitter since they have not been able to fully ripen.

Lesson Plan: Sort Your Salsa

Introduction: Peppers add color, flavor, and texture to salads, pizza, pasta, and ethnic foods. In recent years, salsa has become one of America's favorite condiments. For every bottle of ketchup purchased, Americans are purchasing two jars of salsa. Along with fresh tomatoes, salsa often contains bell and chili peppers.

Objective: Students will analyze, determine ingredient ratios, and explore the essential role of peppers in salsa.

California Standards: CC Math: 3-4.MD.2, 6-7.RP.3

Materials: Fresh salsa that contains peppers, paper plates, toothpicks, cheesecloth, magnifying lenses

Procedure:

1. Before the lesson, use the cheesecloth to drain as much liquid as possible from the salsa.
2. Ask students to raise their hand if they have salsa in their home right now. Discuss the different styles of salsa. Have students raise their hands to vote for their favorite style.
3. Brainstorm ingredients of salsa and record them.
4. Predict the ratios of each ingredient in a salsa recipe.
5. Distribute toothpicks, a paper plate, and two tablespoons salsa to each group. Instruct groups to weigh and record the mass of their salsa.
6. Using toothpicks and magnifying lenses, instruct students to separate their salsa by ingredient. Find the mass of each ingredient. Record data.
7. Use proportional reasoning to convert weights to%ages (or degrees) and create a pie chart.
8. Compare results and discuss how peppers change the color, flavor, and texture of salsa.

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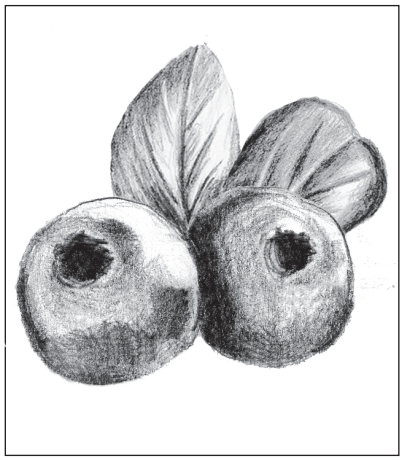
Commodity Fact Sheet

Blueberries

Information compiled by California Blueberry Commission

How Produced – Blueberries are part of the Ericaceae plant family, which includes the flowering azalea and heather plants. They grow best in acidic soil with plenty of water and good drainage. Highbush blueberries—the ones you find in grocery stores—grow on bushes planted in long rows. The bushes can grow up to 12 feet tall, but most peak at about 6 feet. In the spring, clusters of white blossoms pop up all over the bushes and are pollinated by bees. Each blossom eventually becomes a berry—first hard and green, then reddish purple, and finally blue.



California blueberries are harvested from May through July. For the fresh market, blueberries are mainly picked by hand. For other markets, blueberries are gathered with large machines that gently shake each bush so ripe berries fall into a catching frame.

Berries are gathered in large bins and transported by truck or tractor from the field to a packing plant, where they are sorted, cleaned, and packaged in clear clamshell containers. These containers are stored in large refrigerated rooms until they're taken to market.

History – When Europeans arrived on the continent, Native Americans were already using wild blueberries year-round. They dried blueberries in the sun and added them whole to soups, stews and meat, or crushed them into a powder which was rubbed into meat as a preservative. The Native Americans also used blueberries for medicinal purposes. They called blueberries "star berries" because the blossom end of each berry, the calyx, forms a perfect five-pointed star.

Native Americans developed one of the first blueberry baked goods, a simple pudding made with blueberries, cracked corn, and water. Many historians believe it was part of the first Thanksgiving feast.

During the 20th century, people didn't think wild blueberries could be domesticated. In 1908, Frederick Coville, a USDA botanist, began breeding wild blueberry plants with superior genetic traits. In 1912, with the help of Elizabeth White, the daughter of a New Jersey farmer, Coville successfully harvested a crop of plump and flavorful berries like those we enjoy today. The team sold the first commercial crop of blueberries in 1916.

Today, blueberries are found in nearly 4,000 products including pet food and cosmetics.

Varieties – With California's numerous micro-climates, many different blueberry varieties can thrive in the state. There are hundreds of varieties, but only about a dozen are sold commercially. Farmers usually grow several varieties at a time. When blueberries are harvested, the varieties are combined which gives a batch of blueberries its varied colors, textures, and levels of sweetness. Each variety is unique in its size, shape, color, and taste.

Commodity Value – Over the past five years, blueberry production and consumption has almost tripled. California is one of the top six blueberry producing states in North America. California moved 70 million pounds of blueberries into domestic and export markets in the 2019-2020 season. Most of the state's crop stays in California, with some transported to other states. About twelve to fifteen percent is exported, with Canada, Taiwan, and Japan being the top international markets.

Top Producing Counties – With 80 individual producers, blueberries are grown throughout California. In the most recent season, California farmers produced blueberries in 28 counties on nearly 9,000 acres. The greatest blueberry acreage can be found in Tulare County, where blueberries are grown on roughly 2,400 acres. San Joaquin, Kern, and Fresno counties follow Tulare County in total acreage for blueberry production.

Nutritional Value – Blueberries are low in fat, a good source of fiber, and an excellent source of manganese. A one-cup serving of blueberries contains 80 calories and virtually no fat. One serving helps satisfy recommended daily fiber intake. Dietary fiber is important in maintaining digestive health and reducing the risk of heart disease. A single serving of blueberries delivers almost 25% of one's requirement of vitamin C, which helps the body maintain a healthy immune system. Blueberries are high in manganese. Manganese plays an important role in bone development and converting proteins, carbohydrates, and fats into energy.

For additional information:

California Blueberry Commission
(559) 221-1800
Website: www.calblueberry.org
U.S. Highbush Blueberry Council
www.blueberry.org

CALIFORNIA Blueberry COMMISSION

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Blueberry Activity Sheet

Where are California's top 5 blueberry destinations?

Lesson Ideas

- Make a family tree showing several subfamilies, genera, and species related to the Ericaceae plant family.
- Write an expository paragraph highlighting different ways Native Americans used blueberries for medicinal purposes.
- Investigate the history of fruit crate labels. Create a vintage-looking fruit crate label for California grown blueberries.
- Visit *www.calblueberry.org* and rewrite one of the recipes to serve your entire class.
- Create a bar graph comparing the vitamin C content of a variety of fruits and vegetables, including blueberries.
- Early American colonists made blue paint by boiling blueberries in milk. Experiment with making different shades of blue before painting a masterpiece.
- Compare the cost per pound of fresh, frozen, and canned blueberries. Make a bar graph highlighting your findings. Track the cost over time and create a line graph.

Fantastic Facts

1. Blueberry bushes can grow up to 12 feet tall.
2. Blueberries are stored in large refrigerated rooms until they're taken to market.
3. The first commercial crop of blueberries was harvested in 1916.
4. Canada imports more California blueberries than any other country.
5. Tulare County has the greatest blueberry acreage.
6. One serving of blueberries provides the recommended amount of daily fiber.
7. Native Americans used wild blueberries for food and medicinal purposes.
8. Blueberry bushes grow best in acidic soil.
9. Fresh market blueberries are harvested by hand, while other markets (frozen, dried, canned) use machines.

Lesson Plan: Testing Soil pH

Introduction: Blueberries require acidic soils. UC Cooperative Extension recommends a soil pH between 4.8 and 5.5. If you plant blueberries in neutral or alkaline soils (soil pH 7 or higher) the plants will yellow and grow poorly, if at all.

Objective: Students will test soil pH and determine if it is adequate for growing blueberries. Students may amend the soil to attain the proper pH requirements.

California Standards: ELA CC: RST.6-10.3, 7; NGSS: MS-LS1-5

Materials: pH test strips (available at most garden centers), hand trowel, distilled water

1. Brainstorm with the class what plants need to grow. Record ideas. Be sure to include space, water, air, soil, light, and nutrients. Explain that when we talk about soil, there are minimum requirements the soil must meet. One of these requirements is the pH, or acidity, of the soil.
2. Collect a soil sample from a potential planting site. The soil should be collected from approximately 5-10 centimeters below the soil's surface.
3. Place the soil in a bowl. Pour distilled water into the bowl until the soil has the consistency of a milkshake. Stir the mixture to ensure the water is fully incorporated.
4. Hold a pH test strip at the non-reading end and dip the strip into the dirt mixture for 20-30 seconds. Lift the pH strip from the water and dip it briefly in distilled water to clean off the dirt.
5. Use the color-coded key included in your pH test kit to read the pH of your soil.
6. Test the soil pH of several different sites around your home or school. Plot your data on a map. Provide a site recommendation based on evidence for planting blueberry bushes.
7. If your sites tested above pH 7, add acidifying material such as sulfur and ammonium-based fertilizers. Retest the soil. Add additional acidifying material, testing as necessary, until you reach the desired level. Continue to add material periodically to maintain a low pH.

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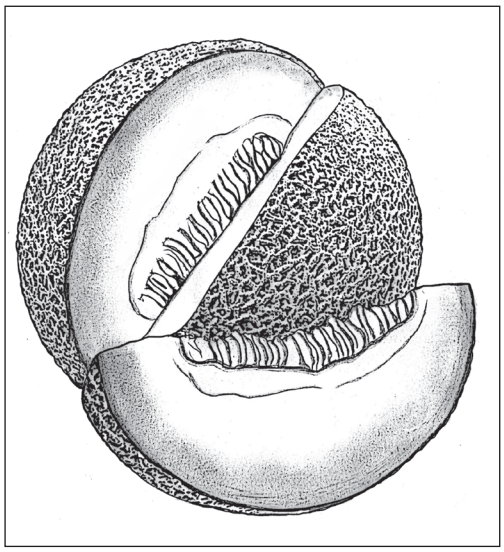
Commodity Fact Sheet

Cantaloupe

Information compiled by the California Cantaloupe Advisory Board

How Produced – California cantaloupes are grown in two main regions—the Southern Desert Area, and on a 200-mile long stretch on the west side of the San Joaquin Valley from Bakersfield to Tracy. The latter area is where 70% of California's crop is harvested each year between June and October. Because of climatic conditions, planting times vary depending on the region in which they are produced. In the San Joaquin Valley, "Westside" cantaloupes are planted in early to mid-April and through mid-summer. These cantaloupes prefer loam or clay-loam soils and are planted on beds that are raised so when irrigation water is applied, only the plant roots get the water and the surface of the bed remains dry. This keeps the cantaloupes from contact with moist soil, which can result in cosmetic blemishes. It also protects against molds and other microorganisms.



Cantaloupes can be identified by the characteristic system of ridges that encompass the outside of the rind and look almost as if the fruit is covered in a net. Look for cantaloupes with prominent, cream-colored ridges. It is perfectly normal for one side, where the cantaloupe has touched the ground as it grows in the field, to be lighter in color or to have smoother ridges.

Cantaloupes are generally harvested, packed, inspected, and graded in the field and then transported to a cold storage facility, where they are cooled to 36°F to 40°F prior to shipment. Some melons are harvested into field bins and brought directly to packing houses where they are placed into shipping boxes.

All cantaloupes packed in California are subject to continuous government inspection, and only cantaloupes that meet the inspection criteria may be shipped. Like all fresh fruits and vegetables, melons should be washed under running tap water before cutting. Store sliced melon with seeds still intact in the refrigerator until it is ready to be eaten.

History – Egyptians wrote about cantaloupes as far back as 2400 B.C. In later times, the Romans described the cultivation of cantaloupes. Gradually their popularity moved west, reaching France in the 1490s, and continued to spread into central and northern Europe. Columbus brought seeds to the New World on his second voyage and reported their cultivation there upon his return. Since the eastern soils and climate of North America weren't well suited for cantaloupes, commercial production eventually moved into the western states. Today, most of the cantaloupes produced in the U.S. are grown in Arizona and California.

Varieties – There are many types of cantaloupes grown in California. Traditionally the melon grown in California was called the Western Shipper, but in recent years varieties have been developed that are able to stay fresh longer. Varieties with a moderately longer shelf life (10 to 15 days depending on storage temperature) are called extended shelf life, or ESL types, while those with the longest shelf life (average of 20 days) are called long shelf life or LSL types. Those melons that slip from the vine (Western and ESL types) will have a smooth round crater where the cantaloupe had been attached to the vine, while the ESL types are cut from the vine and will have a small portion of the stem still attached to the cantaloupe.

Commodity Value – California typically produces about 75% of the nation's domestic supply of cantaloupes. Cantaloupes are generally packed in 40-pound cartons. Production varies greatly, ranging from 500 to 900 cartons per acre. This is equivalent to 20,000 to 36,000 pounds per acre. Over the past five years, the average cantaloupe crop was valued at $194 million annually.

Top Producing Counties – Fresno County grows more cantaloupes than any other California county, but cantaloupes are a major crop in several other San Joaquin Valley counties including Merced, Kern, Stanislaus, and Kings. In addition, cantaloupes are grown in Riverside, Imperial, Yuba, and Sutter counties.

Nutritional Value – Cantaloupes are an excellent source of both vitamin A and vitamin C. A six-ounce serving, or roughly a quarter of a melon, provides 100% of the U.S. recommended daily allowance of each vitamin. Cantaloupes are also high in dietary fiber as well as folacin, a nutrient needed for growth and the development of hemoglobin. All of the nutrition in cantaloupes comes with minimal calories. There are 50 calories in a six-ounce serving of cantaloupe. Cantaloupes contain no fat or cholesterol.

For Additional Information:
California Cantaloupe Advisory Board
(559) 591-5715

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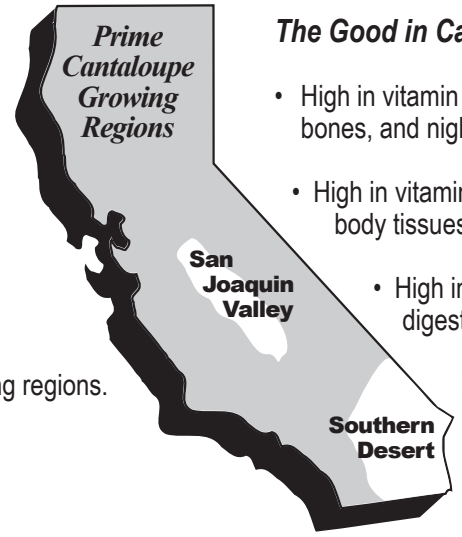
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Cantaloupe Activity Sheet

Cantaloupes for Californians and the World

What it Takes to Grow a Cantaloupe

- Loam or clay-loam soils.
- Raised beds so roots get the water but the melons do not.
- Plentiful water.
- Sunny, hot days.
- Seed variety selection for specific growing regions.
- Minimal rain and low humidity.
- Control of white flies and other pests.



The Good in Cantaloupe

- High in vitamin A essential for healthy body tissue, growing bones, and night vision.
- High in vitamin C essential for strong gums and healthy body tissues.
- High in dietary fiber essential for maintaining a healthy digestive tract.
- High in folacin essential for cell growth and reproduction.
- Low in calories.

Lesson Ideas

- Cantaloupes were named after the Roman town of Cantalupo where they were grown in abundance. Research the history and culture of Cantalupo, Italy.
- Create a poster illustrating the nutritional benefits of cantaloupe. Ask the produce manager at a grocery store to display the informative posters.
- Cantaloupes are members of the gourd family. Find criteria that define the gourd family and make a list of other commodities classified as gourds.
- Create a limerick about cantaloupes. Include facts found on this fact sheet.
- Collect a variety of soil samples. Have students determine which sample would be best for growing cantaloupes and why.
- Estimate the circumference, surface area, and volume of various melons. Verify your results.

Fantastic Facts

1. California leads the nation in cantaloupe production.
2. Fresno County is the greatest cantaloupe producing county in the nation.
3. 10-15 bee visits per flower are necessary, on average, for proper pollination and large melons.
4. Another name for cantaloupe is muskmelon.
5. The fleshy portion of a cantaloupe is usually orange.
6. Cantaloupes grow on a vine.
7. There is evidence that ancient Egyptians and Romans grew cantaloupes.

Lesson Plan: Melodious Melon Poetry

Introduction: Poetry is often used to express feelings and experiences. A didactic cinquain is a five line verse that uses structure and different parts of speech about a subject.

Objective: Students will experience the sights and tastes of cantaloupes and will then write about them poetically.

California Standards: CC ELA: L.6-12.2; L.3-12.3; L.4-5.5

Materials: One cantaloupe for every six people, knife, paper towels, writing paper, pencils.

Procedure:

1. Give each group of students a cantaloupe. Have them write down single words that describe its external appearance.
2. Next, cut the cantaloupe in half. Have students brainstorm a list of adjectives that describe its internal structure.
3. Continue cutting the melons, providing each student with a slice. Have them smell, touch, and taste the melon and then write down words that describe their experience.
4. Have your students write a cinquain describing their melon-tasting experience.

_____

A one word title, a noun that tells what your poem is about

_____, _____

Two adjectives that describe the title

_____, _____, _____

Three action verbs that describe the title

_____ _____ _____ _____

Four-word phrase that tells more about the title

_____

A synonym for the title

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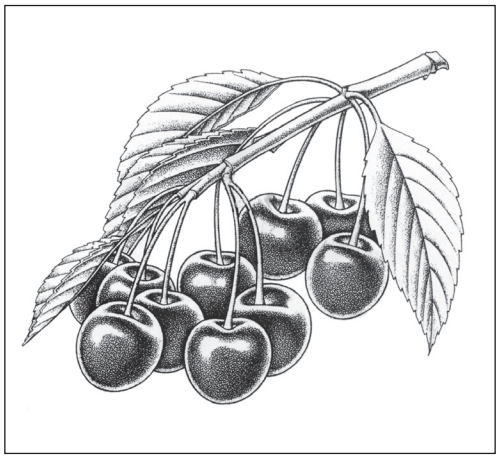
Commodity Fact Sheet

Cherries

Information compiled by the California Cherry Board

How Produced – Cherry trees are grafted to rootstock and planted 16-18 feet apart in straight rows. Farmers can typically grow 150 trees per acre. Trees grow best in deep, well-drained, gravelly to sandy loam soils. Pollination is absolutely essential for production. Because the trees are not self-pollinating, at least two varieties of cherry trees are planted every third tree in every third row, or a ratio of approximately 9 to 1. Honey bees are the main pollinator.



After an orchard is planted, it takes approximately six years until it produces its first major crop. Constant attention is given to each tree every step of the way to ensure a healthy orchard. California cherry harvest lasts late April through June.

Traditionally, color change is used to signal maturity. Sweet cherries for fresh consumption are harvested by hand, usually leaving the stem intact. They are harvested at firm-mature stage to reduce bruising. Sweet cherries intended for processing are also hand-harvested.

Sweet cherries have extremely short shelf lives, and must be handled gently to reduce bruising and oxidation. Cherries are cooled directly using chilled water—a process called hydrocooling—then sorted based on color and size, and packed in shallow flats. The shelf life of fresh cherries is only a few days at room temperature and about two weeks when refrigerated.

History – The sweet cherry originated in Asia Minor, in the fertile area between the Black and Caspian Seas, and was probably carried to Europe by birds. Cultivation began with Greeks, and was increased and expanded by Romans. Trees were planted along roadsides and were valued for their timber as well as their fruit.

Sweet cherries came to the U.S. with English colonists in 1629, and later were introduced to California by Spanish missionaries. In the 1800s, sweet cherries were moved west by pioneers and fur traders to their major sites of production in Washington, Oregon, and California. Cultivars selected at that time still form the base of the industry today.

Varieties – Cherries are members of the Rosaceae family, subfamily Prunoideaea, and are distant cousins to peaches, plums, apricots, and almonds. There are a number of sweet cherry varieties grown in California. The most prominent are Bing, Coral, Brooks, Tulare, Sequoia, Rainier, Chelan, Garnet, and Royal. The Bing variety continues to be the favorite of consumers, with its mahogany-colored skin and sweet, rich flavor. The coral variety has risen in popularity in recent years due to its large size, firm texture, and sweet flavor.

Commodity Value – The U.S. is the second-largest producer of cherries in the world, accounting for more than 10% of world production. Turkey is the leading cherry producer. Washington leads the nation in sweet cherry production followed by California. Sweet cherries rank 32nd among all California commodities. With approximately 650 growers farming more than 42,000 acres, California's sweet cherry crop was valued at $350 million in 2021.

Top Producing Counties – Cherry orchards in the San Joaquin Valley receive the perfect combination of nutrient-rich soil, abundant sunshine, and mild temperatures needed to produce high-quality fruit. In 2021, San Joaquin County produced nearly 48% of the state's total production. Other top-producing counties include Tulare, Fresno, Kern, and Stanislaus.

Nutritional Value – In addition to being a good source of vitamin C, cherries are also high in iron, potassium, dietary fiber, and antioxidants. Anthocyanins found in cherries block inflammatory enzymes, reducing pain. In fact, 20 cherries are 10 times as potent as aspirin and have positive effects on gout and arthritis pain. All in a small package that's low in calories and contains no fat or sodium. Sweet cherries are also considered to be excellent sources of boron. Boron consumption, coupled with calcium and magnesium, has been linked to increased bone health.

For additional information:
California Cherry Board
(916) 441-1063
Website: calcherry.com

CALIFORNIA CHERRIES

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Cherry Activity Sheet

Sweet Cherry Pie Recipe

Pastry for a 9" Two Crust Pie

2 cups flour
⅓ cup plus 1 tablespoon butter
⅓ cup plus 1 tablespoon shortening
1 teaspoon salt
4-5 tablespoons cold water

Preheat oven to 425°F. Place flour and salt into a medium mixing bowl or into the food processor. Cut in shortening and butter and work with a fork or pastry cutter until mixture is like coarse corn meal. If using a food processor, use the "S" blade, sprinkle in cold water, one tablespoon at a time, mixing until all flour is moistened and forms a ball. Chill until ready to roll out for pie crust.

Filling

¾ to 1¼ cups sugar, to taste
¼ teaspoon almond extract
8 cups pitted Bing cherries (about 3½ pounds)
⅓ cup flour
2 tablespoons butter

In a large mixing bowl, stir together sugar and flour. Mix well with cherries. Roll pastry out on lightly floured board. Place bottom crust in 9" pie plate. Add cherry mixture. Sprinkle with almond extract and dot with butter. Cover pie with top crust, crimping edges, and adding slits to allow for steam to escape. Cut a piece of aluminum foil about three inches wide and cover the edge of the pie to prevent excessive browning. (Remove foil during the last 15 minutes of baking.) Bake 35-45 minutes or until crust is brown and juices are bubbling.

Lesson Ideas

- Investigate health benefits of cherries. How do cherries help prevent heart disease?
- Design an informative and attractive cherry display for consumers. Include information about shelf life, handling tips, and recipes. Share your display with a local grocery store.
- Calculate how many cherry trees can be planted on one acre if each tree is spaced 16-18 feet apart.
- Compare and contrast the harvesting techniques for sweet and tart cherries intended for processing or fresh consumption.
- Using a map of California, locate the geographical areas where cherries are grown. Study the climate, seasons, and weather patterns of these areas for similarities.
- Determine the chemistry involved in processing maraschino cherries.

Fantastic Facts

1. Cherries are a good source of vitamin C.
2. San Joaquin county leads the state in cherry production.
3. 31.8% of the nation's cherries are grown in San Joaquin County.
4. Bing, Coral, Brooks, Tulare, Sequoia, Rainier, Chelan, Garnet, and Royal are cherry varieties grown in California.
5. Sweet cherries are ranked 32nd of all California commodities.
6. California is home to approximately 850 growers and 22 packers of all California fresh cherry varieties.
7. Honey bees are essential for cherry blossom pollination.
8. Spanish missionaries introduced cherries to California.

Lesson Plan: An American Legend

Introduction: Cherries have an interesting place in our nation's folklore. One of the most enduring legends about George Washington involves him chopping down his father's cherry tree and, when asked about it, using the famous line "I cannot tell a lie, I did it with my little hatchet." Mason Locke Weems has been identified as the storyteller responsible for this legend.

Objective: Students will investigate the origin of legends, read common American legends, and write their own legend about cherries.

California Standards: CC ELA: RL.3-12.2, W.3-12.3, W.3-8.7, SL.3-12.4

Materials: Internet access, encyclopedia, reference books, paper, pencil.

Procedure:

1. The Brothers Grimm defined legend as "folktale historically grounded." In cooperative learning groups, students may use previous knowledge and experiences to brainstorm characteristics common to legends.
2. As a class, have students share and compare their brainstormed ideas, and research the actual etymology and origin of legends
3. Assign each group an American legend to read and examine. Examples of American legends include the story of Johnny Appleseed, Davy Crockett, and Paul Bunyan.
4. Once students read the legend, challenge them to decipher fact from fiction. Each group may report their findings by providing an objective summary for the class.
5. Instruct groups to write their own legend featuring a historical figure, a character trait, and cherries. Students will need to research their historical figure and determine which traits they are renowned for. Encourage students to use creative writing skills to develop this information into a legend.
6. Have writers share their legend in front of the class. As a group, provide feedback for each story and determine how it exemplifies the traits of a great legend.

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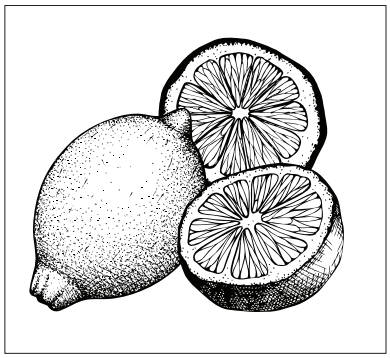
Commodity Fact Sheet

Citrus Fruits

Information compiled by Sunkist® Growers

How Produced – Citrus trees are propagated asexually through a procedure known as grafting which fuses two different varieties of plants. In the case of citrus trees, one variety, the rootstock, is selected for its hardiness and the other variety, the scion, is selected for for its high-quality fruits. The rootstock, grown from a seed, is typically a two- to three-year-old seedling while the scion is a bud from a mature tree. Through grafting, the scion fuses to the rootstock and becomes a new tree. In approximately five years, the tree produces the same variety of fruit that was budded onto the rootstock. The successfully grafted trees are sold to citrus growers through wholesale nurseries and are certified disease-free. There are approximately 270,000 bearing acres of citrus trees in California.



History – Oranges and lemons can be traced back to the ancient Middle East. In Sanskrit, the oranges and lemons were called “Nagrunga” and “Nimbu” and their nectar was used both as a drink and as medicine. The Arabs called oranges “Naranji” while the Romans called them “Arancium.”

All navel oranges are related to each other and can be traced back to the Washington navel tree that still stands today in Riverside, California. Eliza Tibbets, a Riverside pioneer, is credited with planting California’s first two Washington navel trees in 1873. The resulting sweet seedless oranges helped launch Southern California’s modern citrus industry.

Varieties – Citrus fruits of one variety or another are available year-round from California, Arizona, Florida, and Texas. Navel oranges, a consumer favorite, are sweet, seedless and easy to peel. They are winter oranges, available November through June, and derive their name from their distinctive blossom end. Cara Caras are a type of navel orange which is available December through May. They have a rich pink pulp, are naturally sweet, low in acid, and seedless. Valencia oranges, which are excellent for juicing as well as for eating fresh, are summer oranges available February through November. California also produces Moro and Sanguinelli “Blood” oranges, named for their exterior blush and ruby interior flesh.

Traditional lemons, such as the Eureka and Lisbon varieties, are a California classic and available all year long. They have a tart flavor and a zesty peel. Traditional lemons are not typically eaten as a whole fruit but are wonderful flavor enhancers. Meyer lemons have a golden peel and, as a cross between a mandarin and a lemon, are less acidic than traditional lemons.Desert grapefruit are harvested November through December while summer grapefruit are available April through October. Specialty citrus includes Melo Golds and Oro Blancos, grapefruit varieties that are popular with those preferring a sweeter taste. Pummelos, or “Chinese” grapefruit, considered a delicacy among many Asian cultures, are the largest of all citrus fruits. Almost a dozen different mandarin, tangelo, and tangerine varieties, such as Clementines, Gold Nuggets, and Pixies, are available November through May. Most are easy to peel and have a lively flavor. Minneola tangelos, available December through May, are a cross between a grapefruit and a mandarin. They are juiciest variety.

Commodity Value – California is the leading producer of fresh citrus varieties for consumption and second only to Florida in overall citrus production. Both oranges and lemons are among the top 20 commodities produced in the state as listed by the California Department of Food and Agriculture. Oranges and their products are also one of California’s leading agricultural exports. South Korea is the top importer with Canada, Hong Kong, and Japan following closely. Other importers include Singapore, Malaysia, Australia, New Zealand, and Taiwan. Lemons are also a high value export crop. Japan is the largest importer of California lemons.

Top Producing Counties – Most of the nation’s fresh citrus products are produced in California and Arizona. The ideal climate in these areas permits the growth of fruit that is as pleasing to the eye as it is to the flavor. The leading counties in California citrus production include Tulare, Kern, Fresno, Ventura, Imperial, Riverside, and San Diego.

Nutritional Value – Citrus is well known for its high vitamin C content, a key nutrient that supports your immune system and health. Eating citrus is an easy way to meet your daily needs. Cara Cara Navel oranges, also called The Power Orange®, contain 100% of the daily recommended vitamin C intake as well as vitamin A, folate and fiber. Oranges, lemons, grapefruit, mandarin, tangelos and tangerines are great tasting, low calorie foods that are good sources of carbohydrates and fiber. They are also sodium-, cholesterol-, and fat-free.

For additional information:
Sunkist Growers
Website: www.sunkist.com

Sunkist®

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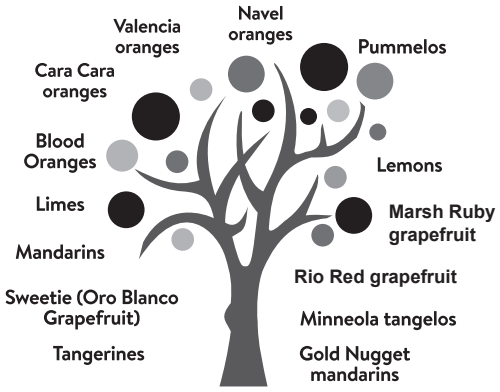
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Citrus Fruit Activity Sheet



Citrus Varieties

Availability of Citrus Varieties by Month												
ORANGES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NAVEL ORANGE	■	■	■	■	■	■					■	■
VALENCIA ORANGE		■	■	■	■	■	■	■	■	■	■	
CARA CARA ORANGE	■	■	■	■	■							■
BLOOD ORANGE	■	■	■	■	■	■						
GRAPEFRUIT												
CALIFORNIA STAR RUBY				■	■	■	■					
MARSH RUBY							■	■	■	■		
PUMMELO	■	■	■							■	■	■
SWEETIE (Oro Blanco)	■										■	■
MELO GOLD											■	■
TANGELOS												
MINNEOLA TANGELO	■	■	■	■								■
MANDARINS												
CLEMENTINE										■	■	■
W. MURCOTT	■	■	■	■	■						■	■
GOLD NUGGET		■	■	■	■	■						
LEMONS	■	■	■	■	■	■	■	■	■	■	■	■

Lesson Ideas

- Test the pH of a citrus variety and two non-citrus fruits. Create a hypothesis and compare your findings.
- Experiment with the effect lemon or lime juice has on cut avocados or apples. Explain the significance of pH and enzymes in cut fruit preservation.
- Use the citric acid of a citrus fruit to create electricity.
- Make orange, lemon, or grapefruit juice popsicles.
- Make a bar graph comparing the vitamin C content of different fruits, including citrus fruits.
- Observe and practice various grafting techniques used in growing citrus trees.
- Perform experiments that show the effects of freezing on citrus fruits.
- Compare the climates of different citrus growing regions of the world.
- Determine the percentage of water in a citrus fruit.
- Measure and graph the peel to fruit weight ratios of several different citrus fruits.

Fantastic Facts

1. California and Arizona produce most of the United States' fresh citrus fruit.
2. Citrus fruit trees are reproduced by grafting.
3. Citrus has nutrients, like vitamin C, that support your immune system and health.
4. Cara Cara Navel oranges offer the most vitamin C with 100%of the daily recommended intake in just one orange. They are called The Power Orange® because they also provide fiber, folate, potassium and vitamin A.
5. Navel oranges are named for the small, navel-like formation on their blossom end.
6. Cara Cara Navel oranges and grapefruit have a natural pink to ruby tint, which is due to the natural presence of the antioxidant lycopene.
7. You can reduce the amount of salt you use without sacrificing flavor by adding lemon zest and juice to your meals.
8. Blood oranges are known for their rich, ruby-colored flesh, which they get from high concentrations of anthocyanins – natural plant pigments that have antioxidant properties.

Lesson Plan: What's Inside?

Introduction: From pummelos to pixies, citrus fruits come in a wide range of sizes. They also differ in quantity of segments, presence of seeds, and volume of juice.

Objective: Students will examine a variety of citrus fruits. They will estimate and then measure the quantitative characteristics of the fruit.

California Standards: CC Math: 3-4.MD.2,4; 5.MD.2; 6.SP.4; HS.N-Q.1,2,3

Materials: A variety of whole citrus fruits (oranges, limes, grapefruit, lemons and tangerines), knife, paper towels, juicer (optional), string, ruler, balance, crayons.

Procedure:

1. Have students predict how many segments and seeds they will see when the fruits are cut cross-wise. Plot the estimates on a graph. Use unit fractions as appropriate.
2. Weigh each fruit whole and record the results. Measure the circumference using a string and a ruler. Plot the results on a graph.
3. Cut the fruit cross-wise and count the number of segments and seeds. Record and chart the results and compare to the estimates.
4. If seeds are present, remove and dry for planting at a later date.
5. Use the juicer to remove the juice from the fruit. Reweigh the citrus halves to determine the juice content of the citrus fruit. Plot the fruit weight and juice weight on a graph.
6. Mix the juices to make a citrus drink for the class to enjoy.

07/20 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Cling Peaches

Information compiled by the California Cling Peach Board

How Produced – Cling peach trees are grown by nurseries and sold to growers for planting during dormancy in the winter months. To encourage early fruit production, trees are planted with a minimum density of 121 trees per acre. The first peaches are seen when the trees are one year old, in "second leaf." At five years, they are in full production, yielding an average of 18 tons of fruit per acre. The orchards require the constant attention and care of the growers. Pruning is generally done during the winter months. Thinning is done in the spring to achieve optimum sized fruit at harvest.

Harvest begins at the end of June in the southern San Joaquin Valley, and concludes soon after Labor Day in the northern Sacramento Valley. Cling peaches are picked when fully ripe. An average picker harvests three tons of peaches each day. Quality peaches at optimum maturity are placed in bins that hold 1,000 pounds of fruit. The fruit is then delivered to canneries that operate seven days a week during peak season.

At the processing plant, peaches are unloaded on a conveyer belt where they are sized and sent into the appropriate pitting machine. Following pitting, cling peaches are peeled and sliced. All peaches are packed in natural syrup to preserve quality and taste. Finally, the cans are sealed, cooked, and cooled. The fresh fruit is generally processed into one of its many products within 24 hours. Quick processing allows the fruit to maintain its nutritional value and quality.

History – Chinese writings more than 3,000 years old give reference to peaches. In California, Spanish padres found that cling peaches thrived along the mission trail. In the late 1700s, President George Washington enjoyed the peaches he grew in his garden at Mount Vernon. The fruit became well established during California's gold rush when settlers began growing and preserving them for commercial sale to miners. During World War I, peach pits were gathered, ground, and used as filters in gas masks.

Varieties – The 16 most common California peach varieties, which account for 92% of all acreage, are separated into four main groups identified by harvest time—from extra early (late June) to extra late (September). The term "cling peaches" was given to these varieties because the flesh of the fruit "clings" to the pit. Today, by-products from peach processing are used in animal feed and compost.

Commodity Value – Cling peaches have a value of $123 million at harvest and increase to more than $450 million after processing. Cling peaches are primarily processed into two major products: canned cling peaches which are diced, sliced or halved, or diced as an ingredient in fruit cocktail. Other products include frozen cling peaches, baby food, and peach concentrates.

Top Producing Counties – Cling peaches are grown on approximately 14,000 acres in the San Joaquin and Sacramento Valleys by more than 400 growers. Five companies are responsible for processing the harvest, around 200,000 tons per year.

Although peaches are grown in 41 states, California accounts for nearly 100% of the commercial production of cling peaches in the United States. Butte, Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Sutter, Tulare, and Yuba counties produce most of the state's cling peaches. These areas are ideal because the dormant season provides sufficient "chilling hours" to set the following year's crop. Later in the season, warm summer days combined with rich soil, and adequate water provide strong fruit growth.

Nutritional Value – California cling peaches are picked at the optimum nutrient level and the canning process locks in nutrients until you open the can and take a bite. Cling peaches are naturally fat-free and contain high levels of vitamin A and vitamin C. They also contain carotene and lycopene, antioxidants that improve skin condition and strengthen eyesight. In 2008, scientists discovered that carotene and lycopene increase during the canning process, supporting the claim that cling peaches are a great source of these nutrients.

For additional information:
California Cling Peach Board

(916) 441-3865
Fax: (916) 446-1063
Website: www.calclingpeach.com

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Cling Peach Activity Sheet

➤ #1

Small bareroot peach trees are planted in the winter. Growers extend the harvest season by planting varieties that mature at various times.

➤ #2

Winter and spring pruning is done by hand.

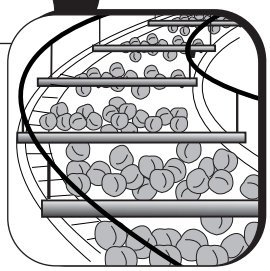
➤ #3

Pickers use both hands to pick several peaches at a time. Their day begins at dawn.

#4 ➤

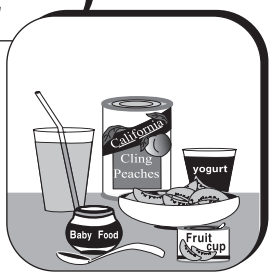
Peaches are sorted at the orchards and then placed into big bins.

#5 ➤



At the cannery, peaches are sorted on conveyor belts, cut into different sizes, and processed.

#6 ➤



Cling peach products including canned peaches, fruit cups, juice, and baby food are available to consumers worldwide!

Lesson Ideas

- Research the characteristics of cling and freestone peaches. Hypothesize the benefits of each and why both are important to the agriculture industry.
- Analyze the nutritional labels on various canned cling peach products. Which cling peach product would you choose for its nutritional benefits? Defend your choice.
- Research how cling peach growers/farmers increase their production and lower labor costs.
- Using the figures on the fact sheet, calculate the total number of cling peach trees in California.
- On a map of California, identify the major counties where cling peaches are grown. What geographic characteristics do these counties have in common and how do these help with cling peach production?
- Create a recipe that includes cling peaches. Have the students practice their math skills by halving, doubling, and tripling their recipes.
- Develop a flow chart showing the innovative and technical processes used to get peaches to homes throughout the county.

Fantastic Facts

1. It takes five years for a cling peach tree to be in full production.
2. The gold miners were the first people to commercially farm cling peaches in California.
3. The average cling peach picker picks four tons, or 8,000 pounds, of peaches daily.
4. Most cling peaches are sold canned.
5. Cling peach trees are pruned twice each year.
6. Cling peaches contain vitamin A and C.
7. California produces nearly 100% of the United States' total cling peach supply.
8. During World War I, peach pits were gathered, ground, and used as filters in gas masks.

Lesson Plan: Cling Peaches – A Convenient Fruit

Introduction: Cling peaches are processed in a variety of ways to provide nutritious, convenient fruit to people throughout the world.

Objective: Students will examine a variety of cling peach products and compute the price per ounce. They will consider the benefits and costs of value-added foods.

Materials: A variety of cling peach products (including canned peaches in different mediums and cuts), baby food products, flip-top individual servings, juice concentrates, and frozen cling peaches with the cost of each item, paper, markers, and pencils.

California Standards: CC ELA: W.3-12.4; CC Math: 7-RP.2, HS.S-ID.1

Procedure:

1. Ask the students why people may eat processed fruit products such as cling peaches rather than fresh fruit. Write the variety of answers on the board. Answers may include taste, convenience, food safety, and year-round availability
2. Have the students create a table of processed cling peach products and record the price and weight of each item.
3. Divide the students into small groups. In additional columns, have students determine the price per ounce of the food products and then rank the food items from most to least expensive.
4. Have students discuss and then write opinions about why some of these products were more expensive than others. Possible answers may include processing requirements, packaging costs, and the popularity of the product. As a class, discuss each group's comments and the term "value added."
5. Have the students taste the cling peach products. Create a line plot that depicts the levels of their popularity.

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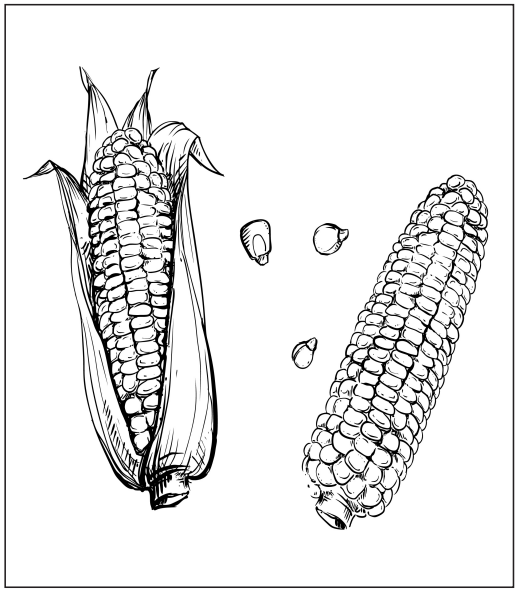
Commodity Fact Sheet

Corn

Information compiled by the California Foundation for Agriculture in the Classroom

How Produced – The most abundant variety of corn grown in the United States is dent corn. In California, dent corn is planted each spring. Seeds are planted approximately two inches deep either into moist, flat ground that is formed into seedbeds after the seed germinates, or into pre-formed seedbeds that are irrigated until germination occurs.



The corn plant has a stalk, and "ears" of corn grow where the leaves join the stalk. An ear consists of a corncob covered with rows of kernels (800 kernels on average). Each kernel is a seed that can grow into a new plant. Leaves, called husks, protect each ear.

A tassel (the male plant part) at the top of a cornstalk contains hundreds of small flowers that produce pollen, which is distributed by wind and gravity to the thread-like silks of the ears. The silks are connected to the female part of the plant. Each silk will carry pollen to a spot on a developing ear and produce a kernel. Stalks can grow from seven to 12 feet tall. Corn is harvested with a combine from August through September. The combine strips the husks and removes the kernels from each ear.

History – Corn, also known as maize, is a cereal grain that was domesticated in Mesoamerica as many as 10,000-12,000 years ago. Corn is a member of the grass family and grew wild in what is modern-day Mexico. Native Americans grew corn as a crop and fertilized the seed by planting it with decaying fish. The fish contained nitrogen, which corn needs for good growth. The earliest known ears of corn were tiny, but centuries of breeding—first by Native Americans, then by early settlers, and later by modern scientists—resulted in bigger, fuller ears of corn.

Today, corn is cultivated on every continent expect Antarctica. The three types of corn grown for human consumption are dent corn (grain), sweet corn (vegetable), and popcorn (food snack). Dent corn is a variety that is harvested when the kernels are dry and mature (dent stage) and processed into thousands of items: starch (baby food and salad dressing); corn syrup, dextrose (bakery goods, fruit juices, antibiotics); oil (margarine and soap); and is primarily used as animal feed. Sweet corn, however, is picked when immature (milk stage) and prepared and eaten as a vegetable rather than a grain. Today's scientists have even developed a new source of fuel from corn products called ethanol.

Varieties – More than 95% of U.S. corn acreage planted is hybrid corn. Hybridization is a breeding process used to improve plant characteristics and increase yield. Hybrid varieties were developed to adapt to specific growing conditions and locations, and they are continually being improved through biotechnology and breeding efforts. Biotechnology uses living organisms (such as microbes, plants, or fungi) to produce useful products and services. Biotech corn offers in-plant protection from insects and herbicides, reduced need for plowing, and higher crop yields. In 2021, 93% of U.S. dent corn acres were planted with biotech traits.

Commodity Value – Corn is America's largest crop, with 85 million harvested acres generating a crop value of more than $90 billion annually. California produces less than 1/10th of one percent of the total dent corn produced in the U.S. with a value of $47 million. Most dent corn in California is used as silage and fed to dairy cows and other ruminant animals. California is the nation's top producer of sweet corn, growing 26% of the U.S. total. In 2020, California harvested 30,000 acres of sweet corn, valued at $194 million.

Top Producing Counties – Imperial County leads the state in sweet corn production, followed by Fresno and Contra Costa counties. San Joaquin County leads the state in grain corn production, followed by Merced and Sacramento counties. Tulare County leads the state in silage production, followed by Merced County.

Nutritional Value – Corn has four major elements: starch, protein, oil, and fiber. One cup of white corn has 130 calories, two grams of fat, five grams of protein, 29 grams of carbohydrates, four grams of fiber and no cholesterol. Oil from the germ or embryo of the kernel is rich in the antioxidants lutein and zeanthin, which are associated with a lower risk of chronic diseases. Fructose (from cornstarch) is a sweetener that helps the body utilize protein.

For additional information:
National Corn Growers Association
(636) 733-9004
Website: www.ncga.com

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Corn Activity Sheet

A historical look at corn improvement

< 5,000 B.C.
Early farmers domesticated wild plants by saving the seeds from the best plants and planting them as next year's crops. This is the earliest form of genetic modification.

5,000 B.C. - 1500s A.D.
Native Americans improved on corn farming by selectively sowing seeds from plants with preferred characteristics for the next year's crop. Settlers from Europe began breeding corn.

Early 1800s
When Europeans started to settle along the eastern coast of North America, two races (varieties) of corn dominated in this region—the Northern Flints and the Southern Dents. Settlers cross-pollinated these two races and created the Corn Belt Dents, the ancestor of nearly all the corn hybrids in the United States.

1870 - 1890
William James Beal produced the first experimental corn hybrid in a laboratory.

1933
Hybrid corn is commercialized by Henry Wallace in the 1920s. Growing hybrid corn eliminated the need to save seeds because the increased yields outweighed the increased costs of annual seed purchases. By 1945 hybrid corn accounted for 78% of U.S. grown corn.

Mid 1900s
Corn yields and quality improve through crossbreeding and hybridization. Crops are developed that contain built-in protection against insect pests, disease causing organisms and harsh environmental conditions.

Present Day
Plant breeders can precisely select single genes that produce desired traits, such as insect resistance and herbicide tolerance.

The corn you buy in the store is different from the plant that scientists believe corn originated from thousands of years ago. The most prevalent scientific theory is that corn was first developed from a wild grass called teosinte and looked much like grass and not the golden vegetable so many people love today. Early civilizations created corn hybrids by cross-pollinating plants from different varieties.

Lesson Ideas

- Using the data given, calculate the value of sweet corn per acre and the value of grain corn per acre. Compare your results and brainstorm reasons why there is a difference in value.
- Corn is used to produce a variety of products, including packaging peanuts, ethanol, disposable tableware, and more. Choose a corn-based product and research the technology used to develop it.
- What role do the four major nutrients found in corn play in nutritional health? Write a report to summarize your findings.
- Read "Four Seasons of Corn: A Winnebago Tradition" by Sally M. Hunter.
- Research how different cultures incorporate corn into their cuisine.
- Draw a poster showing some of the past and present dangers known to threaten corn crops.

Fantastic Facts

1. The tassel is the male part of the plant that contains hundreds of small flowers.
2. Corn was domesticated 10,000-12,000 years ago in Mesoamerica.
3. A cornstalk can grow 7-12 feet tall.
4. Hybridization is a breeding process used to improve characteristics of the plant.
5. 31% of the world's corn is produced in the United States.
6. Tulare county leads the state in the production of corn not consumed by humans.
7. Starch, protein, oil, and fiber are the four nutritional elements of corn.
8. Ethanol is an alternative fuel that is derived from corn.

Lesson Plan: Growing Up with Corn

Introduction: Corn plants will move toward light when growing. Called phototropism, this occurrence is actually the result of increased cell division and growth in the area of the plant that does not receive direct light. The lopsided growth causes the plant to bend toward the light source.

Objective: Students will conduct an experiment to examine phototropism in corn seedlings.

California Standards: NGSS: 4-LS1-1, MS-LS1-4, MS-LS1-5

Materials: A Petri dish or sealable plastic bag with holes punched at the top (enough for one per group), popcorn kernels, absorbent cotton balls, packing tape.

Procedure:

1. Divide students into groups and give each group four kernels of corn, one Petri dish (or plastic bag) and 3-4 cotton balls. Put the cotton balls in the container. Plant one kernel in the moist cotton ball on each of the four sides of the dish or bag.
2. Tape the bags or Petri dishes to the wall in various places around the classroom and in varying degrees of light.
3. Observe how the plant grows, how many days it takes to germinate, and how long the roots grow. Have students document which emerges first, the roots or stem, and which way the roots and stems grow.
4. As students report on their findings, help them use scientific reasoning to understand how phototropism affects the likelihood of successful reproduction.

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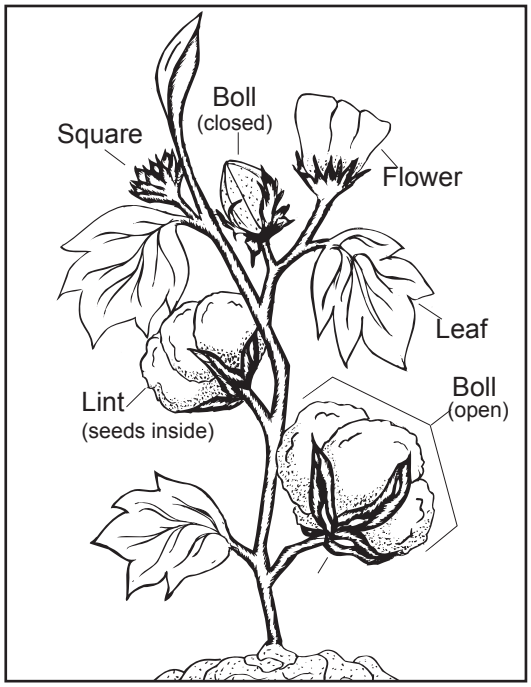
Commodity Fact Sheet

Cotton

Information compiled by the California Foundation for Agriculture in the Classroom

How Produced – In early spring, seeds are planted one to three inches deep, by mechanical planters, in seedbeds. Plants are irrigated, fertilized, and weeded, as needed, during the 25 week growing cycle. The first true leaves appear after two to four weeks with the bud, also known as a "square," appearing about five to seven weeks after planting. The white blossoms become pollinated, turn light pink, and then wither at about nine weeks. Next, the cotton boll develops, producing the fibers and seeds that are harvested. The cotton bolls open naturally over time and a defoliant chemical is applied by ground or air to ensure top quality. This helps the leaves dry and fall off and any remaining closed bolls to open.



A mechanical cotton harvester moves through the field picking the cotton, which is then packed into truckload sized "modules" and taken to the gin. The gin separates the cotton fibers from the seeds. Cleaning equipment removes twigs and other debris. The fiber, now called lint, is packed into 500-pound bales and then transported to textile mills. The cotton is carded or combed, making all of the fibers run parallel, and then spun into thread. Some whole cotton seed is fed to cattle. Some seed is further processed. The fine "linter" fibers are removed and the seed is pressed and cooked, producing cottonseed oil and meal.

Uses – Like lumber, cotton comes in many varieties and qualities, each suitable for different purposes. The long lint fibers are used for many things, most of which begin with a thread, yarn, or cotton fabric. Clothing and bedding items are common products. The smaller cotton fibers, known as linters, are removed from the seed and are used as stuffing for furniture and components of linoleum, plastics, and insulation. Cotton seed oil is used in foods and cosmetics. Cotton seed hulls are eaten by cattle.

History – The oldest cotton fibers and boll fragments, dated from around 5000 B.C., were discovered in Mexico. In 5 B.C., the Greek historian Herodotus reported of a plant that “bore fleece.” Cotton has been worn in India and Egypt for over 5,000 years. Cotton was grown by Native Americans as early as 1500. In England in the 1700s, it was against the law to import or manufacture fabric made of cotton since it was a threat to the sheep and wool industry. American colonists were able to grow lots of cotton, but processing was difficult. It was not until the 1700s that the cotton industry flourished in the United States. It was then that Samuel Slater, an Englishman, built the first American cotton mill. These mills converted cotton fibers into yarn and cloth.

In 1793, Eli Whitney developed the cotton gin, which mechanically separated the seed from the lint fiber. Whitney named his machine a "gin," short for the word "engine." Technology has improved over the past centuries making cotton growth and production much more efficient.

Varieties – There are five main cottons varieties grown throughout the world–Egyptian, American Pima, Sea Island, Asiatic, and Upland. The most prominent types of cotton grown in California are Upland, whose fiber lengths are 13/16 inches to 11/4 inches in length, and American Pima, whose fiber lengths are 15/16 inches to 11/2 inches. Seventeen states in the nation produce cotton with roughly 12 million acres of cotton planted annually.

Commodity Value – Cotton is a leading cash crop nationally, ranking behind corn, soybeans, and wheat. In California, cotton and cottonseed rank 26th and 57th in terms of value of sales by commodity group. In 2021, California’s cotton and cottonseed crop value was more than $93 million.

Top Producing Counties – The majority of cotton is produced in the cotton belt of the United States, ranging along the southern part of the nation from California to Florida and Virginia. In 2020, the top five cotton producing counties in California include Kings, Fresno, Merced, Kern, and Tulare.

For additional information:
National Cotton Council
Website: www.cotton.org
Website: cottonsjourney.com

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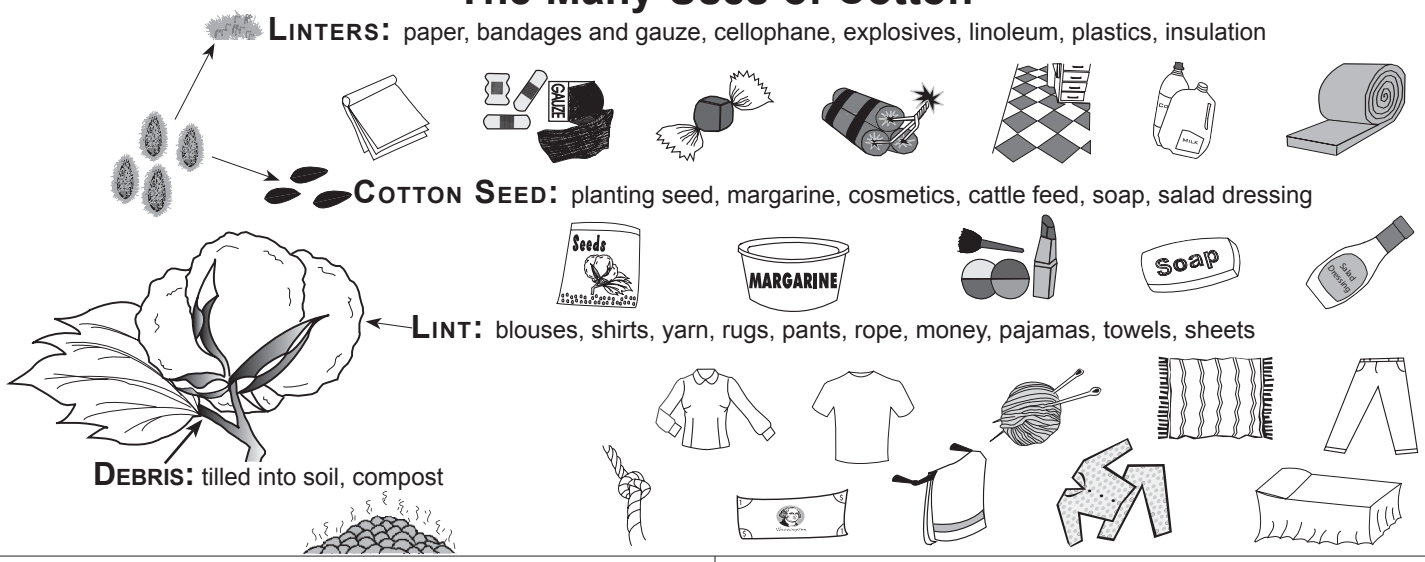
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Cotton Activity Sheet

The Many Uses of Cotton



Lesson Ideas

- Closed cotton bolls are sweet to the taste. Using your own knowledge about photosynthesis, develop a hypothesis explaining this mystery.
- Determine the origins of cotton and wool. Create a list of products that are derived from each commodity.
- Examine clothing labels. How many of the clothes contain cotton? Discuss how cotton is grown and processed into fabric.
- Discuss the history of American cotton. Make a timeline out of cotton rope that is labeled with key events.
- Write biographical essays on Eli Whitney and Samuel Slater.
- Create a model of a universal density bale, whose dimensions are 55" x 21" x 26". Determine its volume and density if a standard bale is 480 to 500 pounds.

Fantastic Facts

1. A universal density bale of cotton weighs between 480 and 500 pounds.
2. 325 pairs of jeans can be made from one bale of cotton.
3. Cotton gins separate seeds from the lint fibers.
4. Eli Whitney invented the first cotton gin.
5. When a cotton flower has been pollinated, the petals turn from white to pink.
6. The oldest cotton fibers were found in Mexico. They were over 7,000 years old.
7. The tiny fibers around a cotton seed are called linters.
8. Textile mills convert cotton fibers to yarn.

Lesson Plan: A Bit of Cotton History

Introduction: Today cotton is grown worldwide and its fibers are incorporated into thousands of products. Historically, its production shaped significant events in American history and its processing contributed to the Industrial Revolution.

Objective: Students will research a cotton-related topic, write an informative text, and create a visual display.

California Standards CC ELA: W.3-12.2,5,7; SL.3-12.4,5

Materials: Access for student use of the Internet and library, display boards or butcher paper, markers and other supplies of your choosing.

Procedure:

1. Divide students into teams of two or three. Have each group select from one of the following topics: cotton and the Civil War; Eli Whitney and the cotton gin; Samuel Slater and cotton milling; the history of cotton songs; the many uses of cotton; cotton bales; cotton production in California; the cotton plant; cotton fabrics; cotton's journey from field to home; other topics of your choosing.
2. Have students explore literature and websites to learn about their cotton topic and record their information. Websites may include cottonsjourney.com and www.cotton.org.
3. Students will create an informative research report on their topic. Supporting references should be cited and the document should be revised and proofed for accuracy and grammar.
4. Have the students take the information they learned and create a visual display that educates their classmates.
5. Share the displays with the school or public.

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Commodity Fact Sheet

Cut Flowers

Information compiled by the California Cut Flower Commission

How Produced – California dominates the domestic cut flower industry because of its favorable Mediterranean climate, which allows for year-round production of an enormous variety of flowers.

Cut flowers are grown in covered greenhouses and outside in open fields. The floriculture industry, which includes the production of bedding and potted plants, shrubbery and fruit stock, as well as cut flowers, and foliage, is extremely labor intensive, requiring as many as 12 workers per acre. Flowers are harvested by hand and then pre-cooled and boxed to prevent heat buildup and premature decay. United States cut flower growers ship approximately two-thirds of their product by truck and the other one-third by air. Transit time from the grower/ shipper to retail outlets varies widely, but can take as little as 24 hours—even to the East Coast. Most flowers are purchased during four key holiday months: February, April, May, and December. Besides holiday sales, flowers are typically purchased for two reasons: to express an emotion or to send "get well" wishes.

Varieties – Color and scent are distinguishing features of cut flowers, however, flowers are generally categorized as one of four types used in floral design; line flowers, mass flowers, filler flowers, and foliage. Line flowers are tall, and give the bouquet height, width, and a balanced look. Examples of line flowers are gladiolus, snapdragons, and curly willows. Mass or "face" flowers give bouquets weight, or mass, and are generally round and full faced. They are usually the focal point of color and interest in a bouquet. Most mass flowers come with only one flower on the end of the stem. Examples include roses, carnations, gerberas, sunflowers, lilies, daffodils, tulips, iris, freesia, zinnias, alstroemeria, protea, and chrysanthemums. Filler flowers, stems with a lot of little flowers and foliage, round out the bouquet and give it a soft, full look. Casual, fresh-from-the garden, bouquets use an abundance of filler flowers to visually connect mass and line flowers. Examples of filler flowers are baby's breath, Queen Anne's lace, heather, and aster. The last type of plant used in floral design is foliage. Foliage refers to the leaves and greenery used to complement floral arrangements. Foliage can also conceal the "mechanics" of an arrangement, such as floral foam. Fern, eucalyptus, salal, and myrtle are all examples of foliage.

Like most California crops, some flower varieties are available year-round while others are not. Many flowers are only available during certain times of the year based on seasonality. For the highest quality and most inexpensive California flowers, consumers can select flower varieties that are in season.

Commodity Value – California was the leading state in cut flower production, accounting for approximately 69% of the total U.S. cut flower wholesale value. The wholesale value of cut flowers produced in California in 2020 was $203 million, which represents a 16% decline from 2019. Across the state retail florists employ approximately 11,000 people.

Top Producing Counties – San Diego is the top producing county in California for flowers and foliage, producing 72% of the state's total. Other top producing counties include Santa Barbara (7%), Ventura (7%), San Luis Obispo (4%), and San Bernadino (3.5%).

History – California is considered the originator of America's commercial cut flower industry. It began in the late 1870s when a Ventura housewife, Theodosia Shepard, was inspired to sell the flowers she raised in her garden. Soon, other women were following suit and bringing their backyard beauty to the local market, and the retail florist profession was born. This period marked a time when French Impressionists began depicting flowers in their paintings and women's magazines began counseling homemakers on flower care and display.

At the turn of the century the state's cut flower industry expanded even further as many immigrant families turned their love of beauty and their botanical talents to flower production. The Chinese, Japanese, Italians, and Dutch revolutionized the floriculture industry in California and make up much of the industry today.

For additional information:
California Cut Flower Commission
(916) 441-1701
Website: www.ccfc.org

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Cut Flower Activity Sheet

Beautiful Bouquet

Lesson Ideas

- Invite a floral designer to visit your classroom to teach about floral arranging and discuss the wide variety of career opportunities in the floral industry.
- Press flowers in waxed paper. Use the flowers to create a botany book, labeling each flower with its common and scientific name.
- Create a manual illustrating the steps of cut flower pollination, fertilization, and reproduction.
- Research the Fibonacci sequence and determine how the sequence relates to cut flowers.
- Look at a variety of flowers. Categorize them as line, mass, or filler flowers. Sort by color, smell, and shape.
- Grow flowers from bulbs or seeds.
- Color a white carnation using food color in water to learn about capillary action.
- Dissect a flower and identify its parts.
- Experiment with different liquids to determine their effect on flower freshness.
- Visit a commercial greenhouse or nursery to learn how cut flowers are produced.

Fantastic Facts

1. Mass, line, foliage, and filler flowers are the four categories of flowers used in a bouquet.
2. February, April, May, and December have the greatest number of cut flower sales because Valentines Day, Easter, Mother's Day, and Christmas fall in these months.
3. One-third of flowers are shipped to floral retailers and wholesalers by air and two-thirds by truck.
4. Besides holidays, flowers are purchased to express emotion or send "get well" wishes.
5. The main expense in cut flower production is labor costs. It requires up to 12 workers per acre.
6. Cut flower production is just one part of the floriculture industry.
7. Theodosia Shepard, a Ventura housewife, is considered the founder of the cut flower industry.

Lesson Plan: Make Your Own Potpourri

Introduction: Potpourri is a mixture of dried, naturally fragrant plant material, used to provide a subtle, natural scent in homes.

Objective: Students will compare flowers based on texture, color, and scent. They will us ratios to mix a potpourri recipe.

California Standards: CC Math: 6.RP.1, 7.RP.2; Visual Arts: 3-4, Artistic Perception 1.5

Materials: Fresh flower petals and herbs, citrus peels, large cardboard sheet, paper towels, large bowl, large jar with lid, cinnamon (sticks or powder), a variety of scented oils.

Procedure:

1. Students will sort plant material into groups based on a chosen trait: color, texture, or shape.
2. Using a mathematical ratio, students choose a specific number of items from each of their sorted groups. Have them create a table to show the ratio relationship they used.
3. Cover a piece of cardboard with paper towels. Spread the plant material on the cardboard and let dry for 2-3 weeks, fluffing the mixture occasionally. Cover cardboard with paper towels.
4. In large bowl, mix dried petals with all other ingredients except scented oil. Put a layer of mixture in the jar. Add 3-4 drops of scented oil. Continue to layer the mixture with the oil until the jar is full.
5. Put lid on the jar and leave 1-2 weeks, shaking daily to mix.
6. Finished potpourri can be used in gift baskets or to make sachets.

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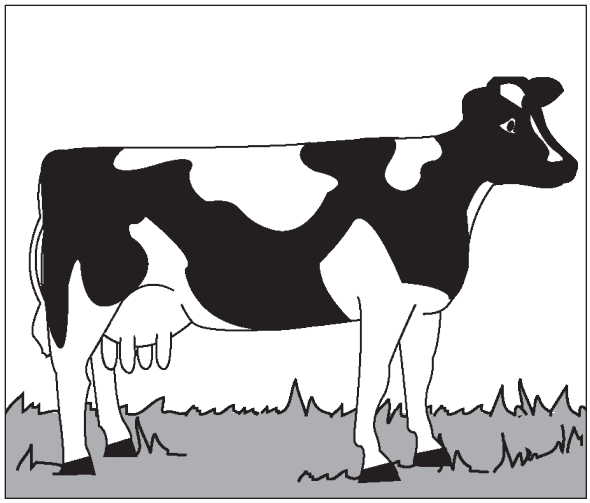
Commodity Fact Sheet

Dairy

Information compiled by the Dairy Council of California

How Produced – California produced 41.3 billion pounds of milk in 2020. Approximately 1.73 million dairy cows produce milk on approximately 1,300 dairies located throughout the state. California's available land, mild climate, and plentiful feed supply make it a desirable and productive location for dairies.



A dairy cow must give birth to a calf to produce milk. A female calf is called a heifer and a male is called a bull. After nine months gestation, a mature two-year-old heifer gives birth and is called a "fresh cow." She produces milk (lactation) for 10 months during which time she is bred again. Her milk production then decreases until she produces no milk (dry) for two months. She will produce milk again after she has her next calf. Cows have a production cycle of four to seven years.

Dairy cows are milked two (sometimes three) times each day. A cow will produce six to seven gallons of milk each day which is more than 2,000 gallons of milk each year.

Cows are ruminant animals, they have four stomach compartments that allow them to efficiently digest many different commodities such as hay, silage (fermented corn, wheat, or hay including the stalks and leaves), and grain (corn, oats, and barley). Cows also consume many different agricultural by-products including cottonseed, almond hulls, sugar beet pulp, and blemished vegetables. A cow drinks approximately 35 gallons of water each day.

History – Anthropologists suggest that Ancient Egyptians, Romans, and Greeks made cheese and yogurt as early as 600 B.C. Missionaries brought the first dairy cows to California in 1770. During the Gold Rush, immigrants brought cows, cheese presses, and churns to California along with their own recipes for making dairy products.

In 1882, David Jacks, a Monterey County dairyman, used an old California mission recipe for cheese and named it Monterey Jack. He was the first person to sell cheese commercially in California. The early 1900s brought changes to the dairy industry including centralized manufacturing and distribution. As California's population increased, the dairy industry focused on improving sanitation, increasing production, and mechanization.

Today, California's dairy industry utilizes technology and advanced food processing systems to provide safe, quality products for California, the United States, and the world.

Breeds – There are five dairy breeds in California. The black and white Holstein is the most common. The Jersey is a smaller cow whose milk is often used for cheese production. The Brown Swiss, Guernsey, and Ayrshire are other breeds used for milk production.

Commodity Value – California has been the nation's leading dairy state since 1993 when it surpassed Wisconsin in milk production. Sales of milk and cream contribute $7.5 billion annually to California's economy. In 2020 California accounted for 18.4% of all U.S. milk production. California's cheese production ranks second in the nation, with approximately 46% of all the Golden State's milk used to make cheese.

Top Producing Counties – In California, a handful of counties continue to be responsible for the bulk of the state's milk production. Tulare, Merced, San Joaquin, Stanislaus, and Kern counties accounts for 72% of the state's total milk production.

Nutritional Value – Dairy products such as milk, yogurt, and cheese contain numerous essential nutrients including calcium, potassium, phosphorus, magnesium, and protein. This "package of nutrients" is critical for the development of strong bones and teeth, maintaining a healthy weight, and reducing the risk of high blood pressure, osteoporosis, and certain cancers. Whether it's protein to help build and repair muscle tissue or vitamin A to help maintain healthy skin, dairy products are a natural nutrient powerhouse.

For additional information:
Dairy Council of California
(877) 324-7901
Website: www.HealthyEating.org

California Milk Advisory Board
Website: www.realcaliforniamilk.com

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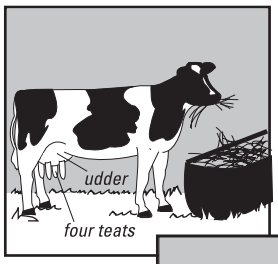
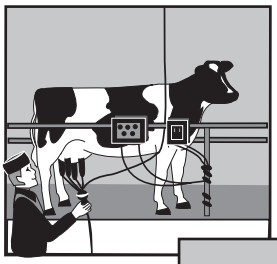
Dairy Activity Sheet



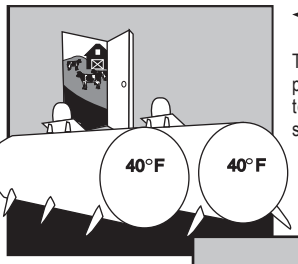
➤ #1

Dairy cattle convert feed energy to milk production. A cow produces milk in her udder. Milk is released through the udder's four teats.



➤ #2

Cows are milked in a milking parlor where the teats are cleaned and attached to a milking machine.

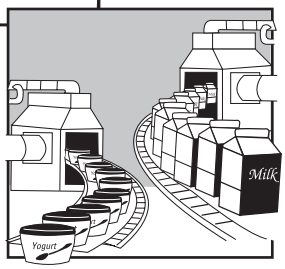


➤ #3

The milk is piped immediately to refrigerated storage tanks.

#4 ➤

The milk is transported daily, in large stainless steel tanker trucks, to processing facilities.



#5 ➤

The milk is pasteurized, homogenized, and processed into many products such as milk, yogurt, cheese, and ice cream.

#6 ➤

A variety of dairy products are available to meet the tastes and nutritional needs of consumers.

Lesson Ideas

- Explore different dairy breeds including their characteristics, history, and origin.
- Compare a cow's diet and digestive process to a human's diet and digestive process. Diagram ruminant and monogastric digestive systems.
- Make butter by shaking heavy whipping cream in baby food jars.
- Create a picture collage of products made from milk.
- Visit a dairy or milk processing facility.
- Taste test different cheese and dairy products.
- Make homemade ice cream.
- Research the nutrients found in dairy products.

Fantastic Facts

1. Cows have four stomach compartments.
2. Cottonseed, almond hulls, sugar beet pulp, and blemished vegetables are all agricultural by-products eaten by cows.
3. Monterey Jack cheese was named by the Jacks family in Monterey, California.
4. Silage is partially fermented grains and grain by-products.
5. On average, a cow produces milk for four to seven years.
6. The most common dairy breed in California is the black and white Holstein.
7. Yogurt, ice cream, cheese, and butter are all dairy products.
8. Calcium is an essential nutrient found in milk.

Lesson Plan: "Milk: From the Farm to the Family" Class Book

Introduction: Dairy products have been around since 600 B.C. However, today's milk production and the production of dairy products is very scientific and technical.

Objective: Students will perform independent research on one aspect of milk and dairy product production. The class will produce a book that depicts the process.

California Standards: CC ELA: W.3-12.2, 4, 7
SL.3-12.4, 5

Materials: Index cards, resources including Internet access, books and encyclopedias, 12" x 18" paper, markers.

Procedure:

1. Write key words or phrases on index cards. These should be one card per student or pair of students. Example words include ruminant, lactation, cow diet, pasteurization, homogenization, etc.
2. Distribute one card to each student or partnership.
3. Have the students research, on the Internet and in libraries, the meaning of their word or phrase and learn how it relates to milk production.
4. Have the students write and roughly illustrate their findings using a standard format.
5. Have the students each read their page to the class. As a class, sequence the information and have the students use technology to create a professional looking page about their findings so that it blends with the work of other classmates.
6. Title the book "Milk: From the Farm to the Family." Bind the book and share it with other classes or at Open House.

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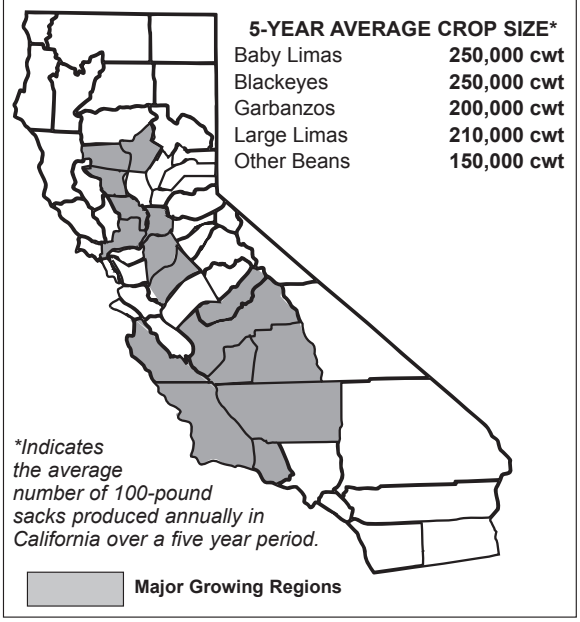
Commodity Fact Sheet

Dry Beans

Information compiled by the California Dry Bean Advisory Board

How Produced – Dry beans are an annual crop; most varieties are planted in the spring or early summer and harvested in the fall. They are often rotated with other crops because they, as with all legumes, have unique root systems which provide natural nitrogen to the soil. When the beans are mature, the plants are cut off at the root and raked into windrows to dry for seven to ten days. Bean harvesters pick up the plants, pods and beans, threshing out everything except the bean seeds which are escalated into a truck. The straw goes out the rear of the harvesters where it is scattered over the soil to provide organic matter for future crops. At the warehouse, the beans are cleaned and placed in 100-pound sacks. They are then shipped to packaging and canning companies for further preparation for the consumer.

Major Growing Regions and Yields of California Dry Beans



History – Dry beans have been produced for thousands of years. Most common varieties originated in Africa, Asia, and the Middle East.
Beans placed in the tombs of ancient Egyptian pharaohs have been found to be viable after centuries of storage. It is thought that the first beans were brought to America by nomadic tribes crossing the Bering Strait into Alaska. Large and baby lima beans originated in Peru, thus the name "lima." They were brought to California on a merchant ship around 1900 and have been grown in the state since then.

Varieties – California producers generally grow "specialty beans," including baby limas, garbanzos, pinks, blackeyes, large limas, and dark and light red kidney beans. Each variety has at least one unique characteristic that makes it useful for particular dishes. California's dry summer climate allows producers to grow disease-free seed beans of more than 50 varieties for planting in other areas of the country.

Commodity Value – California is ranked eighth in dry bean production, accounting for 5% of the nation's total. In 2020, California's dry bean growers grew approximately 29,000 acres, producing 34,800 tons of dry beans valued at more than $54 million. The European Union is the top export market, valued at $4.6 million.

Top Producing Counties – The type of bean grown in a certain area is dependent on the bean's specific growing needs. Blackeyes, which like heat, are grown mainly in Fresno, Kern, Kings, Madera, and Tulare counties. Large limas, which benefit from cool nights, grow in the coastal valleys of Monterey, Santa Barbara, and Ventura counties and in Stanislaus County where the cool evening breeze comes inward from the Bay Area. Kidney beans are grown in Colusa and San Joaquin counties, while other beans are grown in Sacramento, Solano, and Yolo counties. Baby limas are grown in Colusa, Fresno, Madera, San Joaquin, Stanislaus, and Sutter counties. Garbanzo beans, sometimes called chick peas because of their shape, are grown in Fresno, Kings, Sacramento, San Luis Obispo, Santa Barbara, and Yolo counties.

Nutritional Value – Dry beans, known mostly for their high protein value, are also high in fiber and many vitamins and minerals. When combined with small supplements of grain, such as rice or corn, beans can supply all essential amino acids, the building blocks of proteins. Beans are low in fat and sodium and contain no cholesterol or sugar. With their high carbohydrate content, they digest slowly, satisfying hunger and energy needs for long periods of time. Most beans, especially blackeyes, contain high levels of folate, the B vitamin that can help prevent certain birth defects and heart diseases.

A cup of cooked or canned beans provides almost half the amount of iron recommended daily for men, and one-fourth of that recommended for women. Iron is important for building red blood cells to carry oxygen from the lungs to all parts of the body.

For additional information:
Dry Bean Advisory Board
(559) 591-4866
Website: www.calbeans.org

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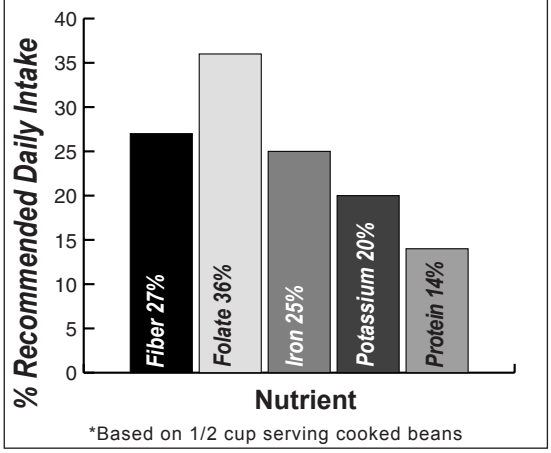
Dry Bean Activity Sheet

Dry Bean Nutrients*



*Based on 1/2 cup serving cooked beans

Dry beans are used in many ways:

- Some eat blackeyes on New Year's Day to bring good luck.
- Japanese make a confectionary paste called *anko* from baby limas.
- Large limas, often called butter beans, are popular in the southeastern part of the United States, and are served with pork.
- Garbanzos and dark red kidneys are a healthy and colorful protein source in salad bars.
- Pink beans and light red kidneys are favorites in chili recipes.
- Garbanzo beans have become very popular due to the increase in hummus sales.

Lesson Ideas

- Discuss the importance of folate in one's diet and how beans can provide this nutrient.
- Create mosaics using a variety of dry beans.
- Use Biuret reagent to compare the amount of protein in various beans and other foods.
- Research the symbiotic relationship between rhizobia and bean plant roots.
- Research why beans produce gas and learn what can be done to reduce the amount of gas in bean dishes.
- Talk about traditions associated with beans.
- Soak beans and dissect them to learn their parts and functions.
- Plant different varieties of beans and note their characteristics.

Fantastic Facts

1. Threshing is when the bean seed is removed from the rest of the plant during harvest.
2. Beans are an annual crop; they must be planted every year to produce.
3. Large limas are the most plentiful variety grown in California.
4. Dry beans are also grown for seed beans, beans that are planted to produce bean plants.
5. Corn and/or rice can be eaten with beans to produce all of the essential amino acids required for protein synthesis.
6. Specialty beans, such as blackeyes and garbanzos, are grown in California.
7. A variety of climates is one reason more than 50 varieties of beans are grown in California.

Lesson Plan: Dry Bean Math Magic

Introduction: Beans provide protein, fiber, and a variety of other nutrients into our diet.

Objective: Students will apply math concepts and skills to solve real-world problems about beans.

California Standards: CC Math: 4.NF.3d,4c; 5.NBT.7, 5.NF.6; 6-7.RP.2,3

Materials: A copy of the following table, MyPlate poster or handouts, calculators (optional), chart paper, markers.

1 lb. dry beans = 5 cups cooked beans
15 oz. can of beans = $1^{2}/_{3}$ cups cooked beans
½ cup cooked or canned beans = 1 serving
1 serving cooked beans = 115 calories
1 serving cooked beans = 8.5 grams protein

Procedure:

1. Distribute the chart above or copy it on the chalkboard.
2. Divide students into small groups and have them solve the math problems below. Have each group show their work on their chart paper and then explain their solutions to the class.

Sample Math Problems

How many people will a one pound bag of dry beans serve if each person were to get one serving of beans? (10 people)

About how many people will one 15 oz. can of beans serve? (3 people)

How much of a one pound bag of dry beans would you cook to feed each member of a five-member family one serving of beans? (½ bag)

Your daily protein requirement is 0.4 grams of protein for each pound you weigh. How many grams of protein would a 100 pound person need to eat daily? How many servings of beans would this person need to eat if the entire protein source for the day came from beans?

Assume one lb. of beans costs $.80. What is the price per serving?

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Commodity Fact Sheet

Eggs

Information compiled by the California Egg Industry Association

How Produced – There are many methods of commercial egg production in the United States, including caged, cage-free, organic, free-range, and specialty eggs. All eggs produced in California are from hens living in cage-free housing, where hens are allowed to roam around a poultry house(cage-free) or outside (free-range). The egg is formed in the reproductive tract of a female chicken, called a hen. Hens start laying eggs at 19 weeks of age. To produce one egg, it takes a hen 24-26 hours. Each laying hen produces 250 to 300 eggs each year. Most eggs are laid between the hours of 7:00-11:00 a.m. Chickens must be fed a balanced diet and plenty of water each day. The hen house must be kept clean and be secure from predators. To keep hens laying year-round, producers must ensure adequate hours of daylight each day, usually 14 hours. When days get shorter in the winter months, artificial lighting helps the hens maintain production. Once laid, eggs move quickly from the hen house to the egg processing area where they are washed, graded, and sized. Eggs are packaged by size, varying from peewee to jumbo, and shipped to retail outlets. Most eggs produced today will be in the supermarket within 72 hours. Eggs have excellent keeping quality; when kept in the egg carton and properly refrigerated, clean eggs that are free from cracks will keep for months. Egg consumption nationwide is estimated at 277 eggs per person, but in California the average is 339 eggs per person. California is the number one egg consuming state in the U.S.

Breeds – The Single Comb White Leghorn is the principle breed used for production of white shell table eggs. There are various breeds that lay brown eggs. The only difference between brown and white shelled eggs is the color of the shell, there is no nutritional difference.

Commodity Value – The farm gate value of California egg production is estimated at $537,600,000 million. In 2020, nearly 14 million laying hens produced four billion eggs in California. With an average price of $1.30 per dozen, the total value of California egg production is $425 million. Five percent of the eggs produced in California are exported to international destinations, approximately 17 million dozen eggs annually. The value of exported eggs, including value-added products such as cooked scrambled eggs and hard-boiled eggs, totals $12 million each year.

Top Producing Counties – One half of California's egg production is in the southern part of the state including San Bernardino, Riverside, and San Diego counties. One half of the state's production is in northern California. The majority of egg farms in northern California are in the San Joaquin Valley with considerable egg production in San Joaquin, Stanislaus, Merced, and Kern counties. Petaluma in Sonoma county was once known as the "egg basket of the world."

History – Egyptian and Chinese records show that fowl have been laying eggs for man since 1400 B.C. Europe has had domesticated hens since 600 B.C. Chickens came to the New World with Columbus on his second trip in 1493. While it is customary to throw rice at weddings in many countries, French brides break an egg on the threshold of their new home before stepping in, for luck and healthy babies. At the time of the French Revolution, the French already knew 685 different ways of preparing eggs.

Nutritional Value – Table eggs are nutrient dense and one of nature's most perfect foods. Foods that supply signi icant amounts of one or more nutrients compared to the number of calories they supply are called nutrient dense. Nutrient dense foods help you get needed nutrients without excess calories. Each egg contains 13 essential vitamins and minerals, 6 grams of high quality protein, and the antioxidants lutein and zeaxanthin. A large egg contains 70 calories and 185 milligrams of cholesterol. Eggs contain the highest quality protein of any food. Studies show that students perform better in school after eating a high protein breakfast. Eggs are also a source of choline, an essential nutrient that contributes to fetal brain development and helps prevent birth defects.

For additional information:
California Egg Industry Association
(916) 441-0801
American Egg Board
(847) 296-7043

Websites:
www.aeb.org
www.incredibleegg.org

California Egg Farmers

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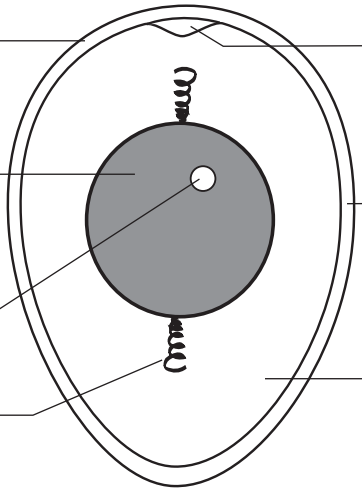
Egg Activity Sheet

What's Inside an Egg?



Shell
Outer covering of egg, composed largely of calcium carbonate. The Shell provides protection to the rest of the egg.

Air Cell
Pocket of air formed at large end of egg. Caused by contraction of the contents during cooling after laying.

Yolk
Yellow portion of the egg and a major source of vitamins, minerals, and fat.

Shell Membranes
Two paper-like membranes. Provide protective barrier against bacterial penetration.

Germinal Disc
Slight depression on the surface of the yolk. If egg is fertilized this is the location where an embryo will form.

Albumen
Clear-like portion of egg also known as the egg white. Albumen is a major source of egg riboflavin and protein.

Chalazae
Cord like strands in albumen. Anchors yolk in center of egg.

Lesson Ideas

- Create an "Egg Yolk Joke Book."
- Calculate the number of eggs produced by commercial laying hens each year. Convert this number to dozens.
- Study the science of egg development in birds.
- Research how eggs were used in the development of vaccines.
- Learn how various chicken feeds affect the color of the egg yolk.
- Research how technology has improved egg production.
- Make Ukrainian eggs and study their history.
- Make a variety of egg dishes such as quiches, omelets and frittatas, and research their history.
- Create the perfect egg package, which prevents egg shells from cracking.
- Dissect a hard-cooked egg and label its parts.

Fantastic Facts

1. On the average, one laying hen produces 250-300 eggs in a year.
2. An average person today eats about 277 eggs each year.
3. The single-comb White Leghorn chicken breed is the most common egg layer in California.
4. Egg proteins are used by nutritionists as a standard for all other nutrients. They are used to grade all other proteins
5. There are 13.5 million laying hens in California. In 2020, California hens produced about 4 billion eggs.
6. Petaluma was once known as the "egg basket of the world."
7. Most eggs arrive at supermarkets within 72 hours after laying.
8. Commercial egg sizes range from peewee (very small) to jumbo.

Lesson Plan: The Bouncing Egg

Introduction: Eggs have a variety of unique characteristics and can be used for a variety of scientific experiments.

Objective: Students will observe changes in an egg shell when placed in vinegar.

California Standards: CC ELA: W.3-5.7, W.6-8.2, 7
NGSS: 4-PS3-3, 5-PS1-4, 5-PS2-1, MS-PS1-2, 5 MS-PS2-1, 2, 4; HS-PS1-4, HS-PS2-1

Materials: One hard-cooked egg per team, white vinegar, plastic container with lid.

Procedure:

1. Without breaking the shell, examine the hard-cooked egg carefully. Record visual observations.
2. Place egg in plastic container. Cover completely with white vinegar and seal with lid. Predict what will happen in one hour, one day, and one week. Record predictions.
3. Observe the egg at the indicated times and record observations. The egg shell should have dissolved and the egg white and yolk should have become rubbery. After rinsing and drying the egg, record what happens when it is dropped. It should bounce.

Note: After each observation, have your students wash their hands. Also, do not eat the eggs.

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Natural Resources Fact Sheet

Forest Resources

Information compiled by the Forest Foundation

Sources – Due to California's diverse topography and climate, the state has diverse forests with many tree species only found in California (endemic). One-third of the state's 100 million acres includes forests, and half of this land is designated as timberland–land managed for timber products.

Forest types include mixed conifer, true fir, east-side pine, and redwood. Another important vegetation type, especially in Southern California, is chaparral. There are 52 species of conifers; these trees produce cones, have need-like leaves, and most are evergreen. Hardwood trees, including oak, maple, and madrone, have broad leaves and may be deciduous.

History – California was initially home to approximately 100 language groups of Native Americans who used the forests to meet their needs for food, forage, and homes. In the early days of the gold rush (1850s), forests were unmanaged, and there was little planning for the future. Today, forests are now owned and managed by the federal government (57%), industry (14%), non-industrial private (26%), state and other public entities (3%), and tribal groups (less than one percent). Diverse ownership ensures diverse management goals and diverse forest structures.

Management – All forest lands, except wilderness areas, are managed. Even parks carry out thinning and prescribed burning to limit invasive species and to control stand density. Forest management goals and practices differ among the various forest managers. Industrial forests are managed primarily for wood products, and non-industrial owners have goals of recreation, wildlife habitat, and retention of healthy forests for the next generation.

The goal of national forests is to sustain forests for multiple long-term benefits. Forest practices such as trimming, harvesting, and prescribed burning are aimed at maintaining forest health–limiting the effects of insects and disease, windstorms, and catastrophic wildfires. All forest managers ensure sustainability through planting and restoration–on average, about 30 million seedlings are planted annually.

To ensure the highest forest management standards for private forests, California has the nation's most restrictive forest practice rules. In addition to these rules, most private timberlands are certified to ensure managers adopt sustainable practices. Three organizations provide sustainability certification: the Sustainable Forest Initiative, the Forest Stewardship Council, and the American Tree Farm System.

Uses – Wood and its components (cellulose, lignin, and oils) are used in many products, including houses, furniture, musical instruments, fences, paper, boats, biofuel, cosmetics, ice cream, toothpaste, plastics, and clothing. Everything that grows above ground can be used to produce more than 5,000 products. Using wood has many advantages over other materials due to it being renewable, biodegradable, and requiring less energy to produce. In addition to these products, forests contribute to our environment. Forest cover is largely responsible for ensuring water quality as snowpack moves through the soil profile and into streams. Forests are also critical in mitigating climate change through the absorption of carbon dioxide and the emission of oxygen, which is fundamentally important for sustaining life.

Economic Value – California has more than 31 million acres of forestland. Forestry and forest product industries contribute 177,000 jobs and $39 billion to the state's economy. At a value of $77.4 million, Humboldt County leads the state in timber production and accounts for 24 percent of the state's total timber value. Other top producing counties include Mendocino, Shasta, Siskiyou, and Del Norte.

For additional information:
The Forest Foundation
(866) 241-TREE
Website: www.calforestfoundation.org

FOREST FOUNDATION

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Forest Resource Activity Sheet

Managed forests can be characterized in three classes: young, middle-aged, and mature.

Young, open forests (0-15 years old) develop after windstorms, fire, or reforested after timber harvesting. They characterize early stages of plant succession and include grasses, berries, shrubs, and trees. There is ample sunlight for growth of plants eaten by herbivores such as deer, and good hunting grounds for predators such as hawks, owls, and mountain lions that prey on woodrats and rodents.

Middle-aged forests (15-40 yrs old) have their density controlled through mechanical thinning that removes some of the over-dense, small, weak trees. The open forest canopy allows the development of understory shrubs and grasses and provides good habitat for raccoons, Cooper's hawks, and bears.

Thinned, **mature** and older forests (40-80+ yrs old) are in the later stages of plant succession and include trees of many ages and species as well as large, rotting logs and some snags (dead trees). These diverse forests provide habitat for woodpeckers, Douglas squirrels, and northern spotted owls.

Lesson Ideas

- List the variety of products in your house that come from trees. On food package ingredients, look for cellulose gum.
- Visit a sawmill, cogeneration plant, or biomass energy plant in your area.
- Use a cross-section of a tree stem to discover how a tree grows, the function of the bark, phloem, xylem, and cambium. Discuss possible factors that control ring width (tree spacing trees, available light, water, nutrients, and climate change).
- Visit a local park to discuss differences among trees–shape, bark color and texture and leaf shape.
- Find the height of a tree or flagpole at your school by using this resource, "How To Measure A Big Tree" (tinyurl.com/bigtreemath).

Fantastic Facts

1. California is home to the oldest (bristlecone pine), tallest (coast redwood), and largest tree (giant sequoia) in the world.
2. On average, 30 million seedlings are planted in forestlands each year.
3. California has more than 31 million acres of forestland, and half of this land is used for timber production.
4. Nine million acres of forests are owned by individuals, with nearly 90% of these owners having less than 50 acres of forest land.
5. Well managed forests ensure that clean water is delivered through the soil to streams and rivers.
6. In 2018, California spent almost $2 billion fighting wildfires, which only accounts for 40% of the actual economic loss.

Lesson Plan: Making Recycled Paper

Introduction: Most paper is made from cellulose obtained from trees. About 60% of all paper is made from recycled cellulose.

Objective: Make recycled paper from old newspaper (An Internet search will provide details and alternatives.)

California Standards: NGSS: K-LS1-1, K-ESS2-2, K-ESS3-1, K-ESS3-3, 1-LS1-1, 1-LS3-1, 2-PS1-2, 3, 3-LS1-1, 3-LS3-2, 3-LS4-2

Materials: Large baking sheet, large bowl, measuring cup, water, a large section of newspaper, rolling pin, butter knife, plastic wrap.

Procedure:

1. Tear newspaper into small pieces about one inch in size or less.
2. Put paper shreds into large bowl and add one cup of water. Keep adding paper, tearing and squeezing it until the mixed pulp looks like cookie dough.
3. Place your baking sheet upside down on a flat surface. Cut a piece of plastic wrap and lay it across the bottom of the baking sheet, tucking the ends underneath the baking sheet. Take a second piece of cut plastic wrap and wrap the rolling pin.
4. Grab a handful (about half) of the pulp and place it in the center of the pan, shaping the pulp into a square.
5. Place multiple layers of newspaper on top of the pulp ball, using the rolling pin prepared earlier, roll the ball from left to right and top to bottom twice removing all excess water.
6. Remove the newspaper from the pulp and discard wet newspaper. Drain any excess water in the lip of the pan. If the mixture sticks to the newspaper, use a butter knife to scrape it back onto the pile.
7. Apply dry sheets of newspaper onto the pulp. Flip the baking sheet over and gently remove the plastic wrap from the pulp, letting the new recycled paper dry completely.
8. When thoroughly dry, peel your new recycled paper away from the newspaper and have students make a gift for someone!

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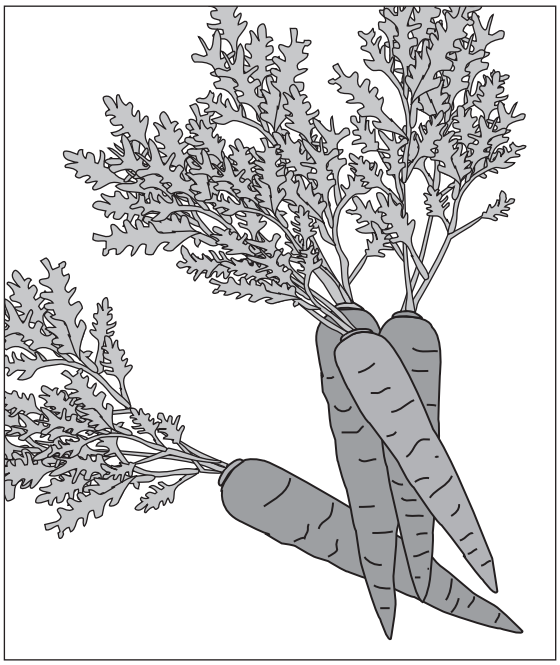
Commodity Fact Sheet

Fresh Carrots

Information compiled by the California Fresh Carrot Advisory Board

How Produced – Carrots, an annual root crop, must be planted in soil that is free of disease and organisms that might affect their color, shape, or texture. This sometimes requires fumigation of the soil. The tiny carrot seeds, 2-3 millimeters in length, are planted in raised beds so the carrots are in position for mechanized harvesting. The growing season ranges from 110 to 180 days, depending upon the time of year, growing conditions, and desired size.



After loosening the earth under the mature carrots, large, self-propelled harvesters lift the carrots by their tops, remove the tops, and load the carrots into a truck and trailer which travel alongside the harvester. The carrots are rushed to packing plants, cooled to 34°F, sorted, cleaned, and packaged within 24 hours of harvest.

History – Carrots, originally cultivated in Central Asia and the Near East, were introduced to the American colonies in the seventeenth century. They were not originally yellow-orange, but a range of purple colors. It is thought that the yellow root evolved from a mutant variety which lacked the purple pigment. Ancient Greeks and Romans used both the purple and yellow varieties for medicinal purposes.

Carrots were first used for food by Europeans during the Middle Ages. In the nineteenth century, carrots were identified as a rich source of beta-carotene. During World War II, British aviators were fed a specially developed English carrot, high in beta-carotene, to overcome night blindness. Plant geneticists continue to develop carrots with higher beta-carotene content, as well as strains that are sweeter and more tender.

Varieties – While there are many varieties of carrots, most consumers are unable to tell one from another since there are only slight differences in taste, shape, or size. Varieties are bred for particular growing regions or specific uses. Normally, carrots grown for the supermarket produce shelf are found in cello bags and are purposely cultivated to be larger than carrots for the baby-cut market. Baby-cut carrots are not necessarily small carrots, but are made from full-grown, small diameter carrots by peeling and cutting them to the desired length. Farmers plant carrots intended for the baby-cut market closer together so the roots stay slim and there is less waste when the carrots are cut to size. Conveniently packaged to be ready-to-eat, baby-cut carrots keep in the refrigerator in their original bag for up to three weeks.

Commodity Value – Production increased by approximately 30% during the late 1990s because of the rather sudden popularity of baby-cut carrots. The market for fresh carrots has leveled off since the turn of the century. California leads the nation in carrot production, accounting for 92% of the nation's total. In 2020, California's carrot growers grew approximately 60,000 acres, producing 1.2 million tons of carrots valued at more than $657 million. Canada is the top export market, valued at $78.6 million. Besides fresh carrots still being available in the familiar cello package as well as the very popular baby-cut carrots, consumers are now also able to find fresh carrots in other convenient shapes such as sticks, coins, and chips, as well as shredded carrots for salads.

Top Producing Counties – Approximately 80% of the nation's fresh carrots are grown year-round in California. Most are grown in and shipped from Kern County. Other growing regions include Imperial County, Riverside County, Monterey County, and Madera County.

Nutritional Value – Carrots are an excellent source of beta-carotene and a good source of fiber. Beta-carotene, the plant pigment that gives carrots their vivid orange color, is converted by the human body to vitamin A. Surplus amounts of beta-carotene are stored in the body's fat cells. One medium carrot provides four times the daily value of vitamin A which helps maintain the health of eyes and skin and reduces the risk of certain cancers. Carrots are fat-free and contain other essential elements in low amounts including vitamin C, potassium, calcium, phosphorus, and magnesium.

For additional information:
California Fresh Carrot Advisory Board
(559) 591-5675

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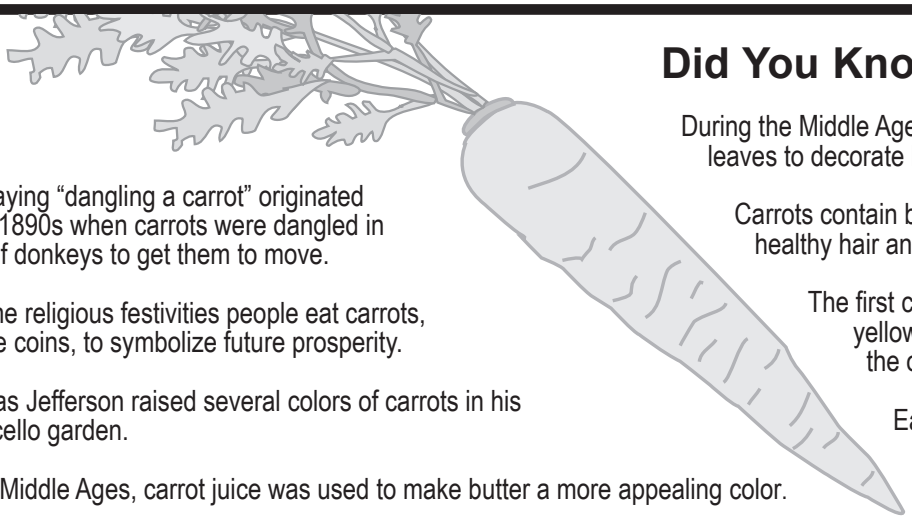
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Fresh Carrot Activity Sheet



Did You Know?

The saying "dangling a carrot" originated in the 1890s when carrots were dangled in front of donkeys to get them to move.

In some religious festivities people eat carrots, cut like coins, to symbolize future prosperity.

Thomas Jefferson raised several colors of carrots in his Monticello garden.

In the Middle Ages, carrot juice was used to make butter a more appealing color.

During the Middle Ages, French women used carrot leaves to decorate hair and hats.

Carrots contain beta-carotene, which helps build healthy hair and nails and keeps eyes healthy.

The first carrots were white, purple, and yellow. In the 1600s, the Dutch developed the orange carrot we eat today.

Early American colonists grew carrots between rows of tobacco to repel beetles.

Lesson Ideas

- Read "The Carrot Seed" by Ruth Kraus.
- Make a list of edible roots.
- Research taproots and fibrous roots and find examples in your garden.
- Make a carrot-shaped book showing the history of the carrot and interesting carrot facts.
- Visit the cafeteria to see how carrots are prepared.
- Ask a professional chef to discuss and demonstrate the many uses of fresh carrots.
- Place a freshly cut carrot top in a shallow dish of water and watch it grow.
- Estimate, then count, the number of baby carrots in a bag.
- Visit a grocery store and make a list of the ways fresh carrots are available to consumers.
- Inside a large drawing of a carrot, write the many nutrients provided by carrots.
- Research and discuss how scientists determine the amount of beta-carotene in a carrot.

Fantastic Facts

1. Most of the nation's fresh carrots are grown in Kern County.
2. Beta-carotene is known to improve night vision.
3. The main reason for the recent increase in carrot production is ready-to-eat, convenient packaging of baby carrots.
4. Carrots come in many colors including orange, white, yellow, and purple.
5. Commercial carrots are mechanically harvested by first loosening the soil underneath the root, then lifting the carrots by their tops.
6. Baby carrots are long, small-diameter carrots peeled and cut into pieces.
7. Ancient Greeks and Romans used carrots for medicinal purposes.

Lesson Plan: Growing Carrots on the Mayflower

Introduction: Grow boxes are used where the soil is in poor condition or when weather is unsuitable for growing crops. Pilgrims used grow boxes on the Mayflower.

Objective: Students will grow carrots in grow boxes and record growth and other observations in a journal.

California Standards: CC ELA: W.3-8.7, SL.3-8.1, RST.6-8.3, WHST.6-8.2, 7; CC Math: 3.MD.4, 4.MD.4, 5.MD.2; NGSS: 3-LS1-1, 4-LS1-1, 5-LS1-1

Materials: 12-inch wide redwood boards, an area to build and place a garden box, nails, hammer, saw, soil mixed with nitrogen-based fertilizer, carrot seeds, water, journals for each student, and resource materials about the Mayflower, Pilgrims, and early colonists.

Procedure:
Explain what a garden box is and brainstorm why and where people use them. Discuss the food conditions and challenges Pilgrims encountered during their voyage to America and the building of their settlement. Why did they use grow boxes?

1. As a class or group, build a grow box that is at least 12 inches deep. Fill the box with soil and moisten.
2. Make rows four to five inches apart. Make a shallow furrow in each row and sprinkle seeds in the furrow. Cover the seeds with a dusting of soil.
3. As the carrots grow, thin the crop when the carrots are as thick around as an index finger, allowing four inches between plants.
4. Keep garden well watered and weeded. Harvest in 70-80 days.

NOTE: Throughout the growth of the carrots, have the students perform various assignments in their journals—observations, poems, find or create recipes, measure and graph root length and stem length, find out what to do with the carrot tops and peelings, etc.

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Commodity Fact Sheet

Green (Snap) Beans

Information compiled by the California Foundation for Agriculture in the Classroom

How Produced – Snap beans, also referred to as green beans or string beans, are edible pod beans that can be grown as bush beans or pole (climbing) beans. California farmers primarily plant bush beans.

Snap beans are a warm season crop, with an ideal growing temperature that ranges from 65° to 85°F. The seed is planted as early as March and as late as August, depending on first and last frost. Seed is planted mechanically by a tractor pulling a planter. The beans are typically planted at 80 pounds per acre, depending on seed size, with two rows on each bed.

Most varieties mature in 50 to 70 days. High temperatures (above 90°F) and late season rains can cause blossoms to drop without the opportunity for fruit to set, greatly reducing yield. Since excess water at any time during growth can increase the plant's susceptibility to root rot infection, many growers use drip irrigation, and some growers still use sprinklers.

Snap bean pods are harvested two to three weeks after blooming. Marketable pods are fleshy, tender, and green for only a short period; they will quickly become tough, fibrous, and overmature if not harvested on time. Pods of desirable length, shape and width are selected, harvested, and graded. Harvesting can be done by hand or by machine. Hand-harvesting allows for multiple harvests of a field, while machine-harvesting is a one-time operation because the plants are destroyed in the process.

Snap beans are highly perishable and should be cooled quickly after harvest. Some growers practice field packing so snap beans are quickly moved from field to cooler with minimum handling. Snap beans destined for further processing are transported to a facility where they are sorted, washed, and trimmed prior to freezing or canning.

History – The common bean was cultivated in ancient Mesoamerica approximately 8,000 years ago. Beans were even found in the mummy covering of a woman in a Peruvian cemetery dating back to pre-Inca civilization. Snap beans originated in the tropical southern part of Mexico, Guatemala, Honduras, and Costa Rica. They spread from this center of origin to North and South America long before European explorers ever arrived.

When early explorers first returned home with these, natives of Central and South America and Europeans used them not as food crops but as ornamentals. They appreciated the butterfly-like blossoms in shades of red, pink, or white, but did not appreciate the tough texture of the pod.

Snap beans, by nature, had a fibrous strip that ran down the length of the bean. This portion had to be removed before it could be enjoyed. This led to the nickname "string beans." Botanists, however, found a way to remove the string through breeding and in 1894 the first "stringless" bean plant was cultivated. Today, commercial varieties of edible pod beans are grown without the strings.

Varieties – Snap bean varieties can be flat or round. The flat types, called Kentucky Wonder, include varieties such as Magnum, Greencrop, and Calgreen. The round types, called Blue Lake, include Jade, Benchmark, Strike, Landmark, and many more. Yellow-podded varieties are Goldrush and Slenderwax. A popular Italian flat bean variety is Romano. Snap beans also come in purple-podded varieties. The purple pods are flavorful, and turn green when cooked.

Commodity Value – California is ranked seventh in the nation for production of fresh market snap beans, while Florida is the top producer. Approximately 95% of the snap bean crop in California is marketed as fresh, with the remainder marketed for processing. In 2020, California's snap bean growers harvested more than 31,000 tons on 5,900 acres throughout the state. The state's crop value reached $20 million in 2020.

Top Producing Counties – Snap beans are produced in many areas of California. Primary production areas include Tulare County, Riverside County, and Orange County.

Nutritional Value – A 1/2 cup serving of snap beans is a good source of fiber, folate, and beta-carotene. Our bodies use beta-carotene to make vitamin A, a nutrient important for vision, immune function, and skin and bone health. Snap beans also contain small amounts of calcium and vitamin C. Green, yellow, and purple snap beans are similar in taste, texture, and nutrition.

For additional information:
Orange County Produce
Website: ocproduce.com

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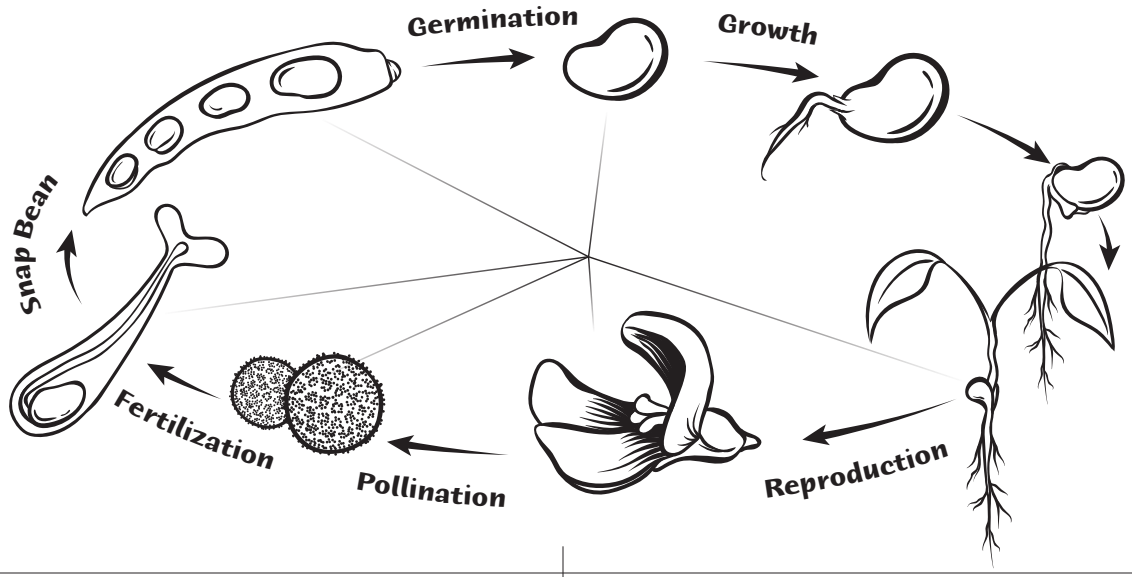
Green (Snap) Beans Activity Sheet



Lesson Ideas

- Dissect a bean and record observations in a science journal. Include labeled diagrams.
- Germinate beans in a damp paper towel inside of a plastic sandwich bag. Tape the bag to a window and make daily observations of bean growth.
- Compare different varieties of snap beans. Make a table to organize data such as color, shape, number of beans, length, and taste.
- Measure the length, mass, and volume of snap bean pods. Create a class average and discuss how common traits have been established through science.
- Design an experiment that identifies the best practices for fresh snap bean storage. Share your findings with your school's food service workers.
- Taste frozen, fresh, and canned snap beans. Record similarities and differences.

Fantastic Facts

1. Snap beans were named for the snapping sound produced when breaking off the end of the pod.
2. The pod color of snap beans can be green, golden, purple/red, or streaked, but the beans inside the pod are always green.
3. Snap beans are nitrogen fixers, which means they draw nitrogen from the air and return it to the soil. Farmers often plant beans to replenish the soil.
4. The Asian Yardlong variety of snap beans have pods that measure up to 18 inches long.
5. The Spaniards initially used snap beans as ornamental plants because they found the bean pods tough, but very much liked the flowers.
6. Snap beans are the third most commonly grown home garden vegetable in the United States, outranked only by tomatoes and peppers.

Lesson Plan: Oh Snap! Finding the Right Soil for Snap Beans

Introduction: Snap beans are grown on many soil types in a pH range of 5.5 to 7.5. Well-drained soils are preferred. Excessively wet soils encourage root diseases and nutrient problems. Snap beans have a semi-shallow root system, and the crop requires frequent irrigation.

Objective: Students will investigate how snap beans grow in different soil types.

California Standards: CC Math: 7.SPC.8; NGSS: MS-LS1-5

Materials: Four identical containers (per group), potting soil, sandy soil, clay soil, snap bean seeds, tray for pots

Procedure:

1. Divide students into groups. Distribute snap bean seeds and containers.
2. Instruct students to fill each container with the same volume of soil, using each of three available soil types. Students must label each container properly.
3. The fourth container will have a student-designed mixture of the three soil types. Have students record the ratios and label the container.
4. Plant the snap beans in each container, at a depth of one inch.
5. Ask students to identify techniques for measuring plant growth. As a class, determine which techniques will be used to measure plant growth in this experiment. These techniques may include: measuring plant height, counting leaves, determining surface area of leaves, observing plant color, or identifying number of days to flower.
6. Apply the same volume of water to the plants at consistent intervals.
7. Routinely employ techniques to measure plant growth, and record measurements in science journals.
8. Use data to graph results and summarize findings.

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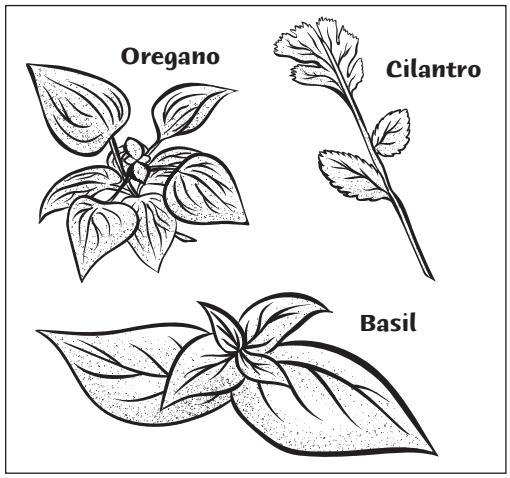
Commodity Fact Sheet

Herbs

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – Herbs are plants useful for culinary, cosmetic, industrial, medicinal, landscaping, decorative, and fragrance purposes. Both fresh and dried herbs may be used for culinary purposes. Additional purposes for processed herbs include décor, essential oils, teas, dyes, and cosmetics. Herbs are among some of the easiest plants to grow. They require plenty of sunlight and typically grow well in most soils.



Oregano – Oregano has purple flowers and spade-shaped, olive-green leaves. Oregano seeds are planted in greenhouses for six to eight weeks before being transplanted to the field in spring. A perennial herb, with creeping roots, oregano requires some irrigation, but once established it requires very little water. Well drained soil is ideal, but it does not require especially fertile soil. Oregano is ready for harvest 45 days after planting, before full flower. Oregano is harvested by hand four to six times per year. If oregano is harvested early in the morning, the need for cooling is minimized. Oregano intended for the fresh market is kept in cold storage, while oregano intended for the dry market is transported to a dehydrator.

Cilantro – Cilantro leaves are light green, feathery, and flat. While the leaves are used as an herb, the dried seeds, called "coriander," are used as a spice. Cilantro seed is grown year-round—in the winter in the desert and in the summer along the coast. Extremely hot weather may cause plants to "bolt," or produce flowers prematurely. Cilantro matures in 40 to 45 days. It is often used as a rotation crop; however, some growers may double-crop each year. Cilantro has a relatively shallow root system and thrives on frequent, short irrigations. It is commonly grown in high-density planting on 80-inch wide beds that are sprinkler irrigated. Cilantro can be harvested by hand and sold in bunches to be used as a fresh herb or mechanically harvested and loosely packed into totes. Once cut, cilantro is immediately cooled and kept in cool storage.

Basil – Basil leaves are glossy and oval-shaped, with smooth or slightly toothed edges. Basil is directly seeded or transplanted to the field in late spring. Most growers use drip irrigation to water basil plants regularly. Basil is a warm season herb, and is harvested from March through mid-November. The timing and method of harvest depends on the use of the herb. For dried basil leaves, the plant is cut just prior to appearance of flowers. To produce essential basil oil, the plant is harvested when the flowers are in full bloom. Fresh basil is typically harvested several times during the growing season. For the fresh market, leaves are washed and stems are packed in bulk boxes in the field and transferred to cold storage rooms. Once transported to the packinghouse, the herb is hand-sorted into plastic clamshells for retail sales. For the dried herb, low temperature drying of the leaves under forced air is used to retain maximum color.

History – The use of plants as herbs has been important to all cultures since before history was recorded. For thousands of years, tribal cultures have used wild and cultivated herbs for medicinal and food purposes. Historians have found documentation that suggests that hunters and gatherers wrapped meat in the leaves of bushes, accidentally discovering that this process enhanced the taste of meat, as did certain nuts, seeds, berries, and bark.

Evidence of early herb gardens dates to Europe in the Middle Ages. Egyptian schools of herbalists have existed since 3000 B.C. Some herbal benefits are symbolic. For example, basil was given to those who needed strength to endure fasting, while rosemary was given to others for remembrance.

Commodity Value – California leads the nation in herb production. In 2019, the value of fresh market organic herbs was approximately $11.7 million. California is the largest cilantro producing state with annual production exceeding 56 million pounds. The United States produces approximately 200 billion pounds of herbs and spices per year.

Top Producing Counties – Ventura, Monterey, Santa Barbara, and San Benito counties lead the state in cilantro production. Individual county data is not available for oregano and basil.

Nutritional Value – Most herbs are highly nutritious, but the benefits are not particularly relevant since they are consumed in limited quantities. Oregano, cilantro, and basil are all good sources of dietary fiber, zinc, and calcium. The essential oils produced from these herbs may be applied topically or used aromatically for a variety of medicinal benefits.

For additional information:
UC Master Gardener Program
Website: mg.ucanr.edu

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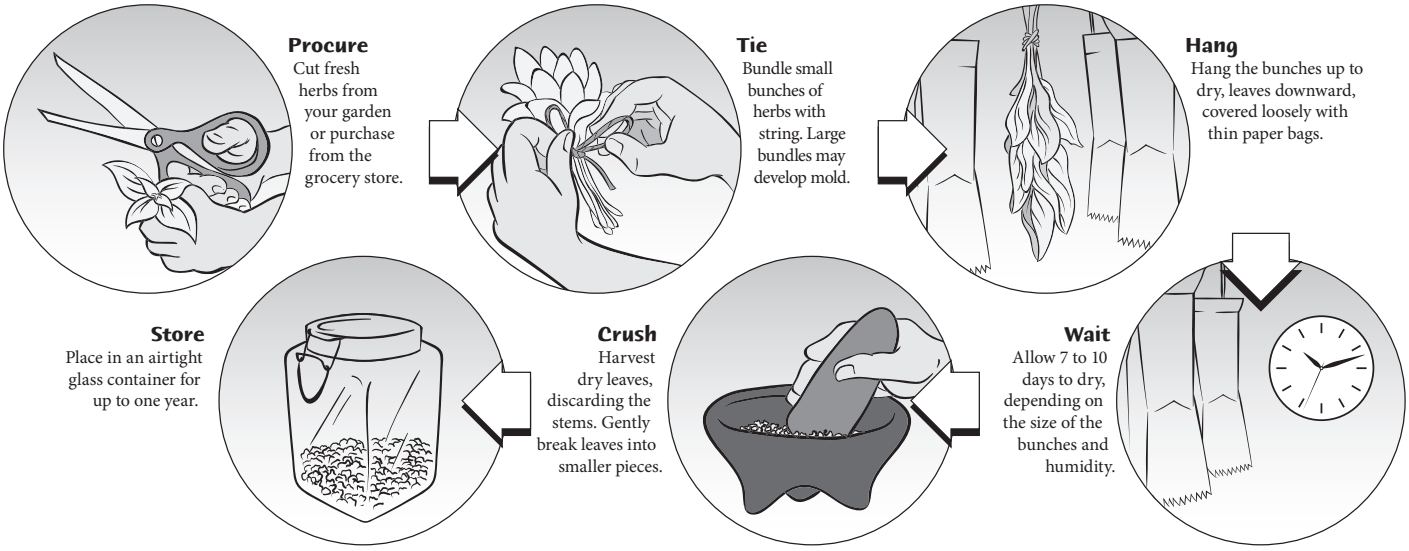
Herbs Activity Sheet



Procure
Cut fresh herbs from your garden or purchase from the grocery store.

Tie
Bundle small bunches of herbs with string. Large bundles may develop mold.

Hang
Hang the bunches up to dry, leaves downward, covered loosely with thin paper bags.

Store
Place in an airtight glass container for up to one year.

Crush
Harvest dry leaves, discarding the stems. Gently break leaves into smaller pieces.

Wait
Allow 7 to 10 days to dry, depending on the size of the bunches and humidity.

Lesson Ideas

- Dry herbs to make a loose-leaf tea.
- Research the medicinal properties of different herbs.
- Create nature prints by using herbs and sun-sensitive fabric or paper.
- Harvest and crush seeds from a cilantro plant to make the spice coriander.
- Make a woven lavender wand.
- Taste and describe different varieties of the same herb.
- Use herbs to make your own potpourri.
- Compare storage methods of fresh herbs.
- Plant your own mini-herb garden in a container.
- Classify herbs by leaf shape, color, and texture.

Fantastic Facts

1. The word oregano comes from the Greek, meaning "joy of the mountain." It was believed Aphrodite, the goddess of love, grew it on Mount Olympus.
2. Cilantro was brought to North America by the English in 1670.
3. Heat diminishes the flavor of fresh herbs, which is why dry herbs are often used in cooking.
4. Oregano was introduced to the United States by soldiers returning from Italy after World War II.
5. Some people may be genetically predisposed to dislike the taste of cilantro.
6. In ancient history, basil was used to embalm mummies.
7. Cilantro seeds are called coriander, which is a spice that has its own unique flavor.

Lesson Plan: Making Herb Butter

Introduction: Butter has long been used as a spread and as a cooking fat. In fact, approximately a third of the world's milk production is devoted to making butter. To make butter, the cream is agitated (stirred up) so that the fat molecules get shaken out of position and clump together. Eventually, after enough agitation, the fat molecules clump so much that butter forms. In this lesson, students will make their own herb butter.

Objective: Students will understand how churning separates the butterfat (the solids) from the buttermilk (the liquid).

California Standards: NGSS: MS-PS1-1, MS-PS1-4; ELA CC: RST.6-8.3

Materials: Heavy whipping cream, finely chopped herbs of your choice, small liquid-tight container with lid, plastic knives, crackers

Procedure:

1. Fill the container halfway with heavy whipping cream and add ¼ teaspoon of herbs.
2. Close the container and begin shaking. The faster you shake it, the faster you make it.
3. As you shake, you will see the cream begin to thicken.
4. Keep vigorously shaking until you see the liquid has separated from the solid.
5. Once you have butter, STOP SHAKING (if you keep shaking the butter will melt). Drain and discard the remaining liquid.
6. Spread butter over crackers and enjoy.
7. While enjoying your butter, discuss how long it took for the butter to form.
   - What variables cause the butter to form more quickly?
   - What is happening at a molecular level?
   - What would be the quickest or most efficient way to turn cream into butter?

02/19 Learn About Ag

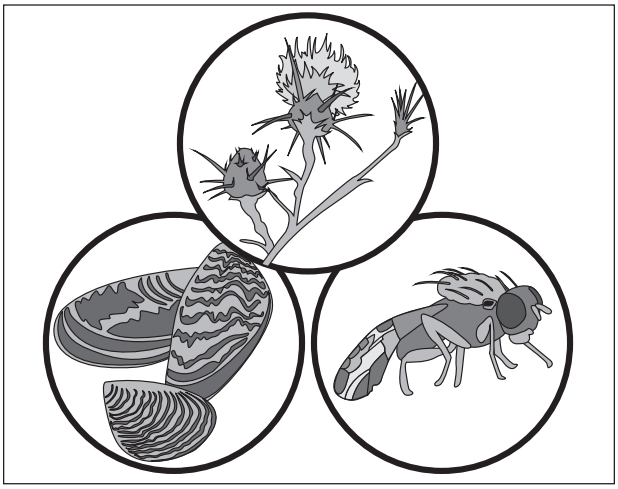
This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Natural Resource Fact Sheet

Invasive Species

Information compiled by the Invasive Species Council of California

Background – Invasive species are organisms that are moved by nature, people, or animals into an ecosystem where they have not been previously found. Some of these organisms are introduced naturally or accidentally by people, while others are introduced intentionally without understanding the harm they might cause. Although most of the organisms brought into our state cause no harm, a few are able to thrive in California to the detriment of native ecosystems, recreation, agriculture, infrastructure, and public or animal health. These invasive species include plants and animals, insects and other arthropods, and pathogens.



Plants – California is home to 4,200 native plant species; approximately 1,800 non-native plants also grow wild in the state. A relatively small number of these non-native plants, approximately 200, are considered invasive. Invasive plants damage ecosystems by displacing native plants, changing the structure of the plant community, and reducing the value of habitat for wildlife and other animals. Medusahead, an annual grass found in California, is an example of an invasive plant that crowds out native grass species, reducing forage for livestock. Water hyacinth is a floating aquatic plant that has invaded the Sacramento Delta and can quickly cover the surface of open water.

Animals – Invasive animals can be divided into two major groups—vertebrates, or those animals with backbones, like mammals, and invertebrates, or those without backbones, like insects and snails. They may cause a decrease of native animals by out-competing them for resources such as food and habitat, by preying on them, or by introducing new diseases. The Norway rat is an example of an invasive vertebrate. These rodents can spread diseases affecting humans and other animals. The quagga mussel is an example of an invasive invertebrate that clogs water systems, crowding out native wildlife and damaging water supply infrastructure.

Insects and Other Arthropods – Insect and other arthropod introductions into the U.S. have increased rapidly over the past century, largely because of increased trade and travel. Invasive insects and other arthropods, such as mites, often sneak onto airplanes and into shipping containers. When the containers arrive and the cargo is unloaded, pests can enter our environment unnoticed, despite government inspectors monitoring shipments. Pests can also cross state lines, "hitchhiking" as unintended passengers on produce, firewood, and other items packed in cars or planes. For example, the Mediterranean fruit fly, or medfly, sometimes enters the state, likely through fruit smuggling, package shipments, and tourists' carry-on luggage. The medfly can infest a wide range of commercial and garden fruits, nuts, and vegetables, and is considered the most damaging agricultural pest in the world. In California, when medfly is found, regulators strip the fruit off of trees and impose quarantines on the movement of fresh fruits and vegetables, and this may cause economic hardship for those producing and selling the produce.

Diseases – Disease-causing viruses, bacteria, fungi, parasitic plants, and other pathogens typically enter the U.S. in infected fruit, plants, soil, equipment, or firewood. Invasive pathogens sometimes need a carrier, or vector, to further their spread in an area or to a new location. For example, the Asian citrus psyllid is an insect pest that acts as a vector spreading the bacterium thought to cause huanglongbing, a devastating disease of citrus trees. This bacterium is transmitted to healthy trees by the psyllid after it has fed on infected plant tissue.

Prevention and Control – Preventing the introduction of invasive species is preferred since eradication is not always successful and it is very expensive and can have economic and environmental impacts. Travelers play an essential role in invasive species prevention. Not transporting food, animals, plants, soil, firewood, or other materials that might harbor an invasive species will help protect our agriculture, forests, and natural and urban areas.

Economic Impact – Invasive species present a significant risk to California's agricultural economy, which is valued at $45 billion. Natural resources and landscapes also face ecological, economic, and aesthetic impacts. Nationally, the damage resulting from invasive species is estimated at more than $100 billion annually.

For additional information:
Invasive Species Council of California
(888) 922-4722
Website: www.iscc.ca.gov

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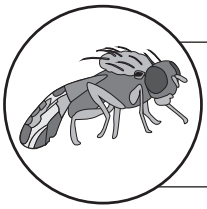
Invasive Species Activity Sheet

Draw a line connecting the invasive species to its region of origin.



The ***Mediterranean fruit fly,*** or medfly, is native to Africa and is a major threat to California agriculture. It has been reported to have infested more than 300 cultivated and wild fruits.

Yellow starthistle is native to Eurasia and is an invasive plant that crowds out native California plants and is toxic to horses.

The ***quagga mussel*** is native to Eastern Europe and is an invasive invertebrate that clogs water systems, crowding out native wildlife and damaging water supply infrastructure.

Lesson Ideas

- Plan and build traps to detect insects in your local area. Place the trap and monitor insect population. Upload images of insects collected to i-Naturalist for specimen identification.
- Examine firewood in a natural area for signs of beetle activity. Discuss how moving firewood increases the risk of spreading invasive species.
- Create a public service announcement that will encourage Californians to protect our agricultural supply from invasive species. Share the PSAs online via podcasts.
- Select an agricultural commodity that is sold and shipped around the world. Investigate locations that would reduce potential pests that may "hitchhike" with the commodity.
- Take a field trip to a California port or airport. Have a state or federal regulator explain inspection procedures.
- Research native plants and the benefits they provide to the environment. Plant a native garden and label each plant appropriately.

Fantastic Facts

1. The total cost of invasive species damage nationwide is more than $100 billion.
2. The Asian citrus psyllid spreads the bacterium that is believed to cause the disease huanglongbing.
3. The Mediterranean fruit fly is considered the most damaging agricultural pest in the world.
4. The quagga mussel clogs waterways and crowds out native wildlife.
5. Vertebrates and invertebrates are subcategories of invasive animals.
6. 4,200 native plant species can be found in California.
7. Water hyacinth is an invasive aquatic plant that has invaded the Sacramento Delta.
8. Prevention is the best was to combat the introduction of invasive species.

Lesson Plan: Invasive Weed Seed Walk

Introduction: The best way to protect natural and agricultural areas from invasive species is to prevent the spread of new invasive species to those areas. When we walk or hike through muddy areas, we often carry soil with us that may include invasive seeds to new locations.

Objective: Students will examine the material that may attach to their shoes and identify methods that reduce the risk of spreading invasive weed species.

California Standards: NGSS: 3-LS4-4, 4-LS1-1, 5-LS2-1, MS-LS2-4, MS-LS2-5, MS-ESS3-3, HS-LS2-6, HS-LS2-7

Materials: Newspaper, magnifying glass, tweezers, shoes that can get dirty

Procedure:

1. Introduce students to a variety of invasive weeds, and what their seeds look like. Have students recognize different ways the seeds can be transported. Explain that some invasive weed seeds are transported unintentionally by hikers as they move through natural environments.
2. Take students on a walk around campus. Lead them through various areas, some dry and some wet, on pavement and on grassy areas.
3. Have students remove their shoes over a sheet of newspaper. Using tweezers and a hand lens, instruct students to identify, categorize, and analyze the plant material and soil that has adhered to the soles of their shoes.
4. Lead a class discussion to highlight their findings. Discuss how wet soil (mud), like glue, causes plant material to stick as students move through different environments. Remind students that invasive species can also be part of the plant material.
5. Have students retrace their steps and consider solutions for reducing the movement of invasive species. Have students create a brochure to advise hikers, bikers, or off-road motorists on best practices to prevent the spread of invasive weed species.

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Commodity Fact Sheet

Lettuce

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – Cool weather is important in lettuce production. Lettuce is a cool-season, annual crop. It grows best in moderate daytime temperatures (73° F) and cool nighttime temperatures (45° F). Lettuce grows well in loose, fertile, sandy-loam soils that are well-supplied with organic matter. Soil should be well-drained and moist, and have a slightly acidic pH of 6.0 to 6.5. Since lettuce seeds are so small, a well-tilled seedbed is essential – large clods will reduce germination. Lettuce is hand-harvested and takes place year-round, from April to October in the Salinas Valley, California and from November to March in Yuma, Arizona. Lettuce is one of the top three vegetables produced in the U.S., along with tomatoes and potatoes. Iceberg lettuce accounts for about half of the lettuce produced in the U.S., with the other half including romaine, butterhead, and leaf lettuces. Growing, harvesting, and marketing of lettuce is mainly from large-scale growers with organic production gaining in popularity. World-wide, the U.S. is the second largest lettuce producer (behind China), with most of the lettuce coming from California and Arizona.

History – Lettuce is one of the oldest known vegetables. There are Ancient Egyptian tomb drawings depicting lettuce dating back to about 2500 B.C. The Egyptians believed it aided in sleep. Originally used for its seeds to produce oil, it then began to be grown for its leaves. Lettuce spread to the Greeks and Romans who gave it its name lactuca. In Rome, Emperor Caesar Augustus built a statue praising lettuce because he believed eating lettuce had cured him of an illness. It was introduced to North America by Christopher Columbus during his second voyage in 1494. Many varieties developed during the 16th through 18th centuries in Europe. Different forms became popular in different regions. Stem lettuce was most popular in the Mediterranean, Egypt, the Middle East, and China. In Northern Europe, butterhead was most popular. Lettuce varieties have changed over the years. The long, thick-stemmed variety of the past, has evolved into leafier, greener types. In recent times, salad bars have become popular (1970s), and salad mixes of pre-washed and packaged greens have become available (1990s).

Varieties – There are several types of lettuce, but the three most common are head, leaf, and romaine. Iceberg lettuce has been the most popular variety, indicated by the largest area harvested, most tonnage produced, and most revenue generated. A shift from iceberg to leaf lettuce being the most popular has occurred in the last ten years. Varieties differ in color, texture, and nutritional value.

Commodity Value – In 2020, lettuce was number six in California commodity values, generating sales of 2 billion dollars. Lettuce is the leading vegetable crop in value of production in California and in 2020, total production increased by 30%. Lettuce is in the top 20 of California exports, coming in at number 13 with $285 million in sales. Canada takes in the highest amount of California grown lettuce exports at 89%. Imports of lettuce to California are limited to less than 5%, and come from Mexico and Canada.

Top Producing Counties – Monterey County is the top lettuce producing county, producing more than 60% of the crop, followed by Imperial County that producing 14% and Santa Barbara that producing 8%. Lettuce is easy to grow and yet sensitive to temperature – frost damages it, and heat causes the stem to grow quickly and the plant to go to seed. Ideal conditions are mild weather, and moist, fertile soil, which explains why the coastal counties do well in spring and summer months and Imperial County and Arizona do well in winter months.

Nutritional Value – Lettuce is low in calories, fat-free, cholesterol-free, and low in sodium. It has 11 calories per cup. Lettuce contains dietary fiber along with omega fatty acids that promote good health. Lettuce contains minerals like manganese, magnesium, potassium, iron, phosphorus, and calcium. Presence of these mineral compounds decreases harmful free radicals in the body and improves the body's immune system as well as protects from viral infections and related diseases. Lettuce contains vitamin A (which helps protect the eye), vitamin C, thiamine, and vitamin B6.

For additional information:

California Leafy Green Products
(916) 441-1240
Website: www.safeleafygreens.org
YouTube: youtube.com/user/CALeafyGreens

Leafy Greens Council
(716) 517-0248
Website:www.leafy-greens.org

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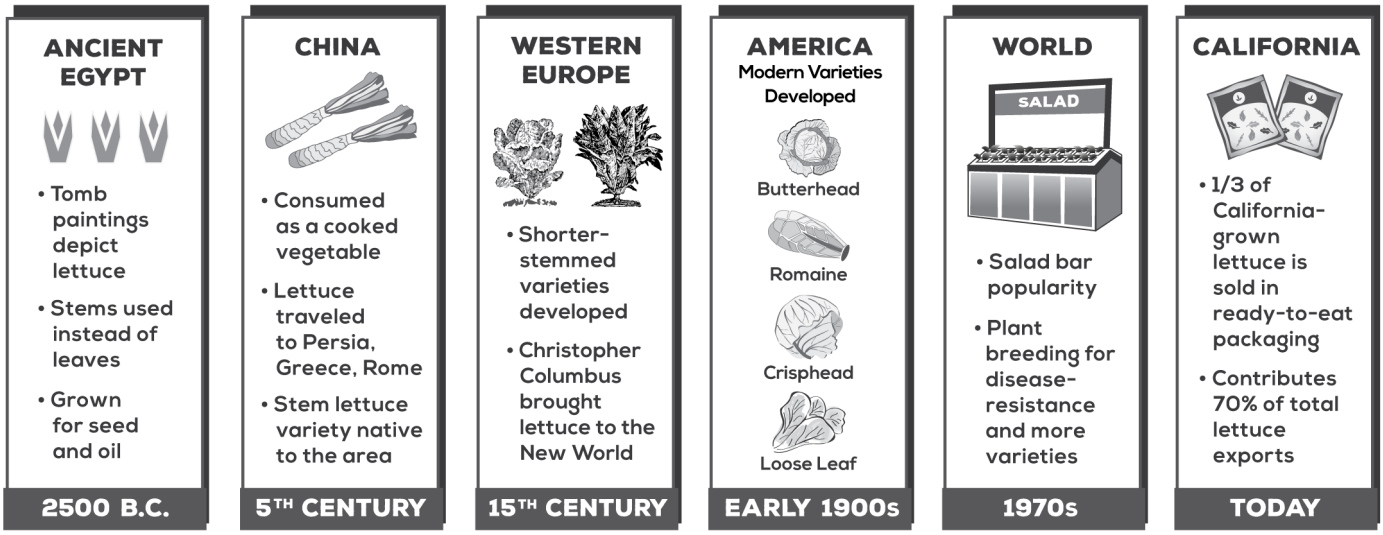
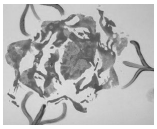
Lettuce Activity Sheet



Lesson Ideas

- Research ready-to-eat bagged lettuce. Include when it started and its success. Compare its popularity to head lettuce.
- Make an artistic salad using leafy greens and other vegetables.
- Identify and illustrate different lettuce varieties.
- Research Lettuce Mosaic Virus and/or the Soil-Dwelling Springtail.
- Create a green smoothie recipe.
- Using the art principle of perspective, research and draw a lettuce or other agricultural field.
- Create artwork using lettuce head stamping (art, see below).



Fantastic Facts

1. Lettuce is a member of the sunflower family.
2. Over 90% of lettuce sold in the U.S. is grown in California and Arizona.
3. California is the “salad bowl’ of America, producing a year-round supply of lettuce, celery, broccoli, and cauliflower.
4. Americans consume 30 pounds of lettuce per person each year.
5. The first modern iceberg variety was created by TW Whitaker of the USDA and was named Great Lakes, although it was developed in California.
6. Lactuca sativa is the botanical name for common garden lettuce.
7. Drawings of lettuce are found on ancient Egyptian tombs.
8. Lettuce was recently grown, harvested, and eaten on board the International Space Station.

Lesson Plan: Growing Lettuce From a Stem

Introduction: Lettuce and other leafy greens can be grown from a cutting. Have your students design a science experiment to observe the phenomenon. Research and find out why it works.

Objective: Students will investigate what plants needs to grow.

California Standards: CC ELA: SL.3-12.4, WHST.6-12.7
NGSS:4-LS1-1, 5-LS1-1, MS-LS1, HS-LS1

Materials: Stems or cuttings from heads of lettuce, bowls, water, observation tools–notebook, pencil, thermometer, ruler.

Procedure:

1. Brainstorm what plants need to grow. Ask what would happen if we cut the stem of the lettuce off and put it in water? Have students make predictions. Students will work in groups.
2. Bring in heads of lettuce for each group. Cut the stem off about one inch from the bottom. Save for the experiment. Use the lettuce for a class salad.
3. Place the cut stem in a bowl of water. Add about ½ to one inch of water.
4. Place the bowl in the window or under lights.
5. Draw a picture and record other measurements such as date, time, temp, size, lettuce type, etc.
6. Change the water in the bowl every other day and observe the cutting every day. Watch for new leaves and roots. Make observation notes.
7. After two weeks, you may plant your lettuce in a pot or outside. Continue to make observations.
8. Research why the plants were able to grow after being cut and only with sun and water. Consider other experiments you can conduct to improve lettuce growth.
9. Have groups present their results using evidence, data, and a model to support their findings.

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Commodity Fact Sheet

Mushrooms

Information compiled by the Mushroom Council

How Produced – The life of a mushroom begins in a laboratory as a tiny grain, but it will eventually grow into flavorful mushroom in just five steps.

Step 1 – Composting: At the farm, the grower prepares a growing medium called compost. The compost is often made from wetted straw, horse manure, hay, and/or crushed corncobs. The grower mixes the ingredients and waits for them to decompose. Once the material is broken down, they bring the compost inside to pasteurize it. Pasteurizing kills any insects or pests and removes ammonia, which formed during decomposition. This step is important because the compost provides nutrients for the mushrooms to grow.

Step 2 – Spawning: The mushroom compost must be inoculated with mushroom spawn for mushrooms to grow. Growers start the process by sterilizing a mixture often composed of rye grain, water, and chalk. The grower spreads this mixture across the compost and the spawn will begin to appear as a white to blue-white mass throughout the compost. The compost will fully grow with spawn in about 14 days.

Step 3 – Casing: The pasteurized compost is placed in stacked, wooden trays. A top-dressing, called casing, is layered onto the compost. This is where the mushrooms will eventually form.

Step 4 – Pinning: This is the growth stage where the shape of the mushroom forms, appearing like pins. From this point, it takes about three months to produce the first mushrooms for harvest.

Step 5 – Cropping: Mushrooms develop at varying rates, so harvest can take six to 10 weeks. Once all of the mushrooms are picked, the trays are emptied, and the growing area is pasteurized with steam before a new crop is started. Mushroom farms today are highly technical operations with computerized systems to monitor each point in production.

History – The first record for the cultivation of mushrooms in Western cultures was around 1650 in Paris, France. Over time, different cultures cultivated a variety of mushroom species. The United States began mushroom cultivation in 1865, and Americans have been able to cook mushrooms in their kitchens since then. Before this time, mushrooms were mainly reserved for condiments.

Varieties – The most popular mushroom is the white button, representing approximately 90% of mushrooms consumed in the United States. Crimini mushrooms, also known as baby bellas or browns, are similar in appearance to the white button, but have a light-tan to rich-brown cap and a firmer texture. Portabella mushrooms are another popular variety. Known as the "vegetarian meat," they have a meat-like texture and flavor. Specialty mushroom varieties include shiitake, maitake, oyster, beech, and royal trumpet.

Commodity Value – Today, mushrooms are commercially produced in almost every state. As the top mushroom producing state, Pennsylvania accounts for approximately 65% of the total U.S. production. California is the second largest mushroom producing state, accounting for 20% of total U.S. mushroom production.

Top Producing Counties – In California, mushrooms are primarily grown on the coastal strip between San Mateo and San Diego. The leading mushroom growing counties include Monterey, Santa Clara, Ventura, San Diego, and San Mateo. As the top producing county, Monterey County alone accounts for nearly 50% of California's total production.

Nutritional Value – Mushrooms are a produce powerhouse of nutrients. Few foods naturally contain vitamin D, but mushrooms are unique for being the only source in the produce aisle and one of the few non-fortified food sources that do. Mushrooms are low in calories, fat-free, cholesterol-free, and low in sodium. Mushrooms provide selenium, potassium, B vitamins, and ergothioneine, a naturally occurring antioxidant that helps protect the body's cells.

For additional information:
Mushroom Council
(816) 251-4512
Website: www.mushroomcouncil.com

fresh MUSHROOMS

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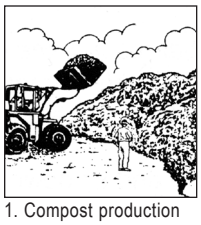
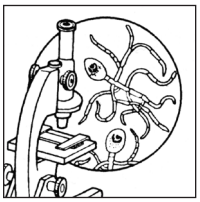
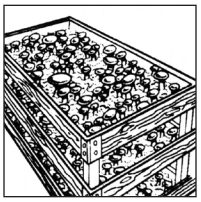
Mushroom Activity Sheet

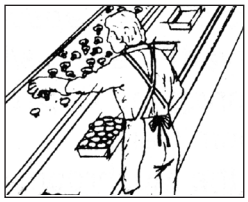
Mushrooms to Market

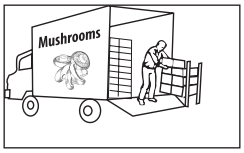

1. Compost production


2. Spawn production

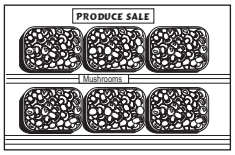

3. Mushroom growing


4. Mushroom harvesting


5. Mushroom packaging



6. Mushroom transporting



7. Mushroom sales


8. Mushroom cooking


9. Enjoyment

Lesson Ideas

- Persuade the class that your chosen mushroom variety is the best. Create a convincing, fact-based advertisement and develop a supporting sales presentation.
- Determine the current market price (per pound) for different mushroom varieties. Weigh the mushrooms, convert data from dollars per pound to dollars per gram and compare the price.
- Egyptians believed mushrooms were the plant of immortality. Research specific mushroom rituals for ancient civilizations.
- Compare the energy flow of autotrophic plants and heterotrophic fungi. Create a Venn diagram showing the similarities and differences.
- Identify nutrients found in mushrooms and their effects on human health. Develop a tri-fold brochure to illustrate the health benefits.
- Research each mushroom variety. Create a fictional, multi-paragraph story that features one of the mushroom varieties as the main character. Follow the mushroom's experience from spawn to supper.

Fantastic Facts

1. Monterey County produces the most mushrooms in California.
2. The white button variety is the most popular variety of mushroom.
3. The portabella mushroom variety is known as the "Vegetarian Meat."
4. Potassium, copper, vitamin D, phosphorus, and ergothioneine are all nutrients found in mushrooms.
5. A typical mushroom harvest lasts six to 10 weeks.
6. Light is not required for mushroom growth.
7. Up to one million pounds of mushrooms can be produced annually from one acre of land.
8. Pasteurization is a process that kills insects and pests while removing ammonia from the compost.
9. It is not safe to eat mushrooms found outdoors. Only eat mushrooms bought at a market.

Lesson Plan: Mushroom Dissection

Introduction: Mushrooms are natural wonders. Very different from plants, these fungi have cell walls made of chitin and do not go through the process of photosynthesis.

Objective: Students will identify and dissect several different varieties of mushrooms.

California Standards: CC ELA: W.3-12.7; NGSS: 4-LS-1, MS-LS-1

Materials: Scalpels, tweezers, microscopes, microscope slides and cover slips, magnifying glasses, paper, tape.

Procedure:

1. Review mushroom anatomy with the class. Discuss varieties of mushrooms and make observations about visual differences and structural similarities. Discuss the important role mushrooms and all fungi serve in the ecosystem.
2. Distribute three different varieties of store-bought mushrooms to the class. Each student/group should have one mushroom.
3. Instruct students to identify and record their given mushroom variety. Have students carefully bisect the mushroom to reveal the internal components. Students may either draw their mushroom specimen or tape their specimen to a piece of paper. Guide students in labeling the following parts: hyphae, fruiting body, mycelium, cap, gills, stipe (stalk), ring, pores, and scales.
4. Demonstrate use of the scalpel to take a small sample of mushroom tissue for microscopic observation. Students place their mushroom sample on a slide, view, and record observations Challenge students to also draw their magnified tissue sample and label cell wall, cross wall, nuclei, and cytoplasm.
5. Students compare findings and submit completed lab reports.
6. Conclude the experiment by reviewing the unique qualities of mushrooms and their exceptional nutritional value.

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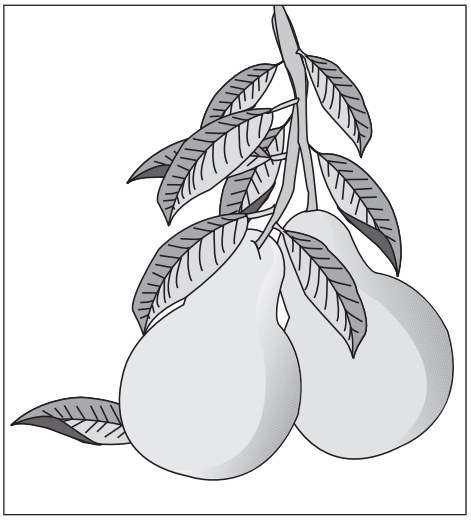
Commodity Fact Sheet

Pears

Information compiled by the California Pear Advisory Board

How Produced – Rich soil, plenty of water, warm days, and cool nights are the best conditions for pear growth. Pear trees are in production for an average of 50 to 75 years, although some pear trees still produce after 100 years.



In winter, trees are pruned and replacement trees are planted. It takes five to seven years for a tree to produce fruit. Pear trees are unique since they are self-pollinating. They do not need bees for this process. The California pear harvest begins in late June and continues through September. The pear is one of the few fruits that does not ripen on the tree, so growers pick the fruit when it is mature, but green, and not yet ripe. Pears are harvested by hand, placed into bins and transported to a packing house. The pears are graded for quality, sorted by size, and packed for the fresh market or sent to a processing facility. Next, pears are cooled to slow down the ripening process. To initiate ripening, pears are brought to room temperature.

Pears are processed into canned pears, fruit cocktail, juice concentrate, and baby food products, and are often dried. They can be found in such items as fruit juices, baked goods, and snack foods like fruit roll-ups.

History – In eighth century B.C., pears captured the praise of the Greek poet Homer, who referred to them as a "gift of the gods." The Romans proceeded to use grafting techniques to develop more than 50 varieties and introduced cultivated pears into other parts of Europe.

The Bartlett pear was developed in England in the seventeenth century by a schoolmaster named John Stair. He sold some cuttings to a horticulturist named Williams, who further developed the variety and renamed it after himself. Early Americans brought pear seedlings across the Atlantic to the Massachusetts Bay Colony. In 1812, nurseryman Enoch Bartlett discovered the pear variety and, unaware of the pear's true name, distributed it as a "Bartlett." However, it is still known as the "Williams" pear around the world. Bartlett cuttings eventually came west when the forty-niners headed for the great California Gold Rush and continue to grow in California today.

Varieties – The pear, scientifically known as *Pyrus communis*, is a member of the rose family. The Bartlett comprises 71% of California's pear acreage and 78% of its tonnage. The Bartlett has a teardrop shape with thin skin that turns from green to yellow when it ripens. When California Bartletts are golden yellow, they are ready to eat. Remember to handle gently to avoid bruising.

Other California varieties include Bosc, Seckel, Comice, Red Pear, French Butter, Golden Russet, and Forelle. Each has its own distinct shape, color, and flavor. The Red Sensation variety was discovered as a "bud sport" on a Bartlett tree. A bud sport is a tree limb that naturally transforms and develops a different fruit variety from that of the original.

Commodity Value – California produces 18% of all pears grown in the United States, ranking number three in the nation. California produces approximately 121,000 tons each year and adds almost $60 million to its economy. California exports more than 17% of its fresh crop. Canada and Mexico receive more than 80% of California's exports.

Top Producing Counties – Pears are grown in two primary growing regions of Northern California on approximately 6,000 acres. The regions are divided into "early" and "late" districts based on the timing of the harvest. The early district, called "River Pears," spans the upper Sacramento Valley of Sutter and Yuba counties and along the Sacramento River Delta in the counties of Sacramento, San Joaquin, Yolo, Solano, and Contra Costa. The early district produces about two-thirds of California's annual pear crop. The late district, called "Mountain Pears," spans Mendocino, Lake, and El Dorado counties. This area produces approximately one-third of California's pears annually.

Nutritional Value – One medium pear provides 16% (four grams) of the daily requirement for dietary fiber, 10% of the daily requirement of vitamin C, and a healthful source of potassium. One pear has approximately 100 calories and contains no cholesterol, sodium, or saturated fat.

For additional information:
California Pear Advisory Board
(916) 441-0432
Website: www.calpear.com

CALIFORNIA PEARS

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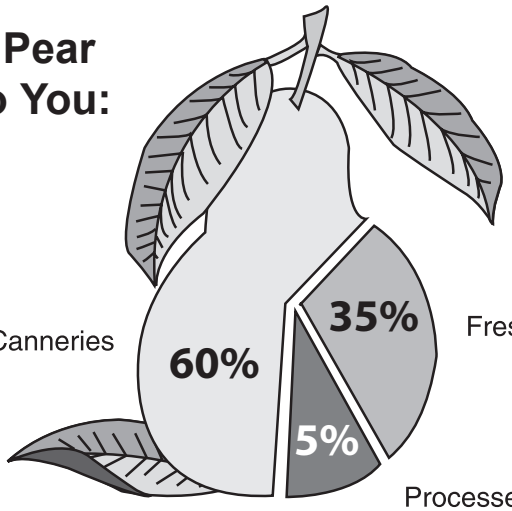
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Pear Activity Sheet

From Pear Tree to You:

How Are Pears Consumed?



Canneries

Fresh market

Processed into dried fruit, baby food, and juice products.

Lesson Ideas

- Slice a pear in half. Find the stem, core, shoulder, flesh, seeds, skin, and calyx.
- On a map of California, identify the River Pear and Mountain Pear districts.
- Dehydrate pears and calculate the percent water loss.
- Compare the color, taste, and texture of various pear varieties. Graph or chart your results.
- Examine pear fruit cells under a microscope. Observe the sclerenchyma cells, which give pears their unique texture.
- Dip the tips of your thumb and little finger on an inkpad and make pear prints.
- Write a song or poem about pears highlighting their unique characteristics.
- Create a collage of food products that contain pears.

Fantastic Facts

1. It takes five to seven years for a pear tree to produce fruit.
2. The pear is one of the few fruits that does not ripen on the tree, so growers pick the fruit when it is mature, but green, and not yet ripe.
3. Consumers can initiate ripening in pears by storing them at room temperature.
4. The Greek poet, Homer, referred to pears as a “gift from the gods.”
5. The Bartlett pear is sometimes called the Williams pear because a horticulturalist named Williams originally developed the variety.
6. A bud sport is a tree limb that naturally transforms and develops a different fruit variety than the rest of the tree.
7. A medium pear provides 16% of the daily requirement for dietary fiber.

Lesson Plan: Ripe for the Taking

Introduction: Since pears do not ripen properly on trees, growers pick pears while they are still green, but mature. Most consumers want to buy Bartletts that are just starting to “break color” from green to yellow, yet only half of grocery chains ripen Bartletts in the backroom. A considerable amount of time and money has gone into informing grocers how to properly ripen pears as well as increase their shelf life. Pears are considered ripe when they are slightly soft when gently pressed on the stem end of the fruit.

Objective: Students will compare the ripening rates of pears under various conditions.

California Standards: CC ELA: W.3-5.4, WHST.6-12.2; NGSS: 3-5-ETS1-1, MS-ETS1-1, MS-PS3-4, HS-ETS1-3

Materials: Unripe pears for each variety you are testing, thermometers, resealable plastic bags, supplies determined by students.

Procedure:

1. Explain to the students that pears ripen best after they have been picked. Have the students think of variables that may affect the ripening rate of pears and brainstorm a list of variables that can be explored in a classroom setting.
2. Have the students create and perform an experiment that will test one aspect of fruit ripening. One such experiment is described in step three below.
3. Place two sets of three pears each in a resealable plastic bag. Place one bag in the refrigerator and one on a countertop. Record temperatures. Over the next few days, record temperatures, and changes in fruit color and firmness. Compare the ripeness of the two sets of fruit.
4. Have the students discuss the results of each of the performed experiments.
5. Individually or as a class, have the students write a memo or cardboard box cover that explains to the grocer how to store and ripen pears. Or, have students design an ad that explains to consumers how to ripen pears at home.

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This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Pickling Cucumbers

Information compiled by Kruger Foods

How Produced – Cucumbers are an annual plant typically planted in mid-March up until August. The time from seeding to harvest is roughly 55 to 70 days depending on the seed variety. Due to the short season, many growers (farmers) plant two crops of cucumbers yearly, while others use cucumbers as a crop rotation—meaning they plant it after a different crop has been planted and harvested. Cucumber harvest runs from May through November. Cucumbers are grown for fresh market (slicing cucumbers) and processing (pickling). Pickling cucumbers are typically harvested by machine. The perfect cucumber for pickling is the right color and size, and doesn't have a lot of seeds. After harvest, pickling cucumbers are transported to a briner where they will be washed, graded, sized, and placed in a tank of brine (a mixture of vinegar, salt, garlic, and spices) to be fermented and turned into pickles. Dill weed is added to the tanked cucumbers during the last stage of fermentation to create dill pickles. Kosher dill pickles have been manufactured and certified in accordance with Jewish dietary laws. They are made with dill and garlic added to the brine, and are more robust than typical dill pickles. To make sour or half-sour pickles, cucumbers are placed into a brine mixture that doesn't include vinegar and then refrigerated. The longer they remain in the mixture, the more sour they will become. Sweet pickles are placed into a sweet mixture of vinegar, sugar, and spices. Some variations include Bread and Butter, Candied, and Hot.

History – Cucumbers are one of the earliest known cultivated vegetables and originated in India. They were used not only as food but also for medicine. The ancient civilizations of Mesopotamia pickled cucumbers about 4500 years ago. Cleopatra thought that pickles enhanced her good looks. Julius Caesar and Napoleon both fed pickles to their troops for physical and spiritual strength. Christopher Columbus brought cucumbers to the New World—he even grew cucumbers to pickle in Haiti. Columbus's ship stocker, Amerigo Vespucci, stocked the ships with plenty of pickles to prevent scurvy outbreaks. The name "America" actually came from Amerigo Vespucci, the pickle merchant.

In 1659, New York Dutch farmers grew cucumbers in what is now known as Brooklyn. They were cured in barrels and sold at market stalls as "Kosher Dills."

In 1900, Henry J. Heinz of ketchup fame, set up one of New York's first large electric signs on the corner of Fifth Avenue and 23rd Street. It featured a 40-foot long pickle and 1,200 light bulbs.

Varieties – Cucumbers are part of the Cucurbitaceae family which includes gourds, pumpkins, watermelon, and squash. There are hundreds of varieties, but there are basically four types: slicing, pickling, burpless, and specialty. Slicing cucumbers are generally longer, with thicker, waxed skin.

They are good for eating fresh. Pickling cucumbers are generally shorter, firmer, and crisper. Varieties planted in California include Eureka and Valaspik. Burpless cucumbers are generally longer and thinner, easy to digest mild-tasting, and contain fewer seeds. Specialty cucumbers are unique in shape, color, and taste. An example is the lemon cucumber.

Commodity Value – Approximately 100,000 acres are devoted to growing pickling cucumbers in the United States. They are grown in more than 30 states, and in California, most are grown in the agriculture-rich Central Valley. California is ranked third in cucumber production, accounting for 10% of the nation's total, only behind Michigan and Florida. In 2020, California's cucumber growers grew approximately 6,000 acres, producing 46,500 tons of cucumbers valued at more than $22 million.

Top Producing Counties – The top producing counties for pickling cucumbers include: San Joaquin, Stanislaus, Solano, Yolo, San Benito, and Imperial counties. Cucumbers grow well in the Central Valley because of the moderate Mediterranean climate, low humidity, and heavy, dry ground.

Nutritional Value – Cucumbers are 96% water and are low in fat, sodium, and calories. A one-half cup serving has eight calories. Pickles are also low in fat. One large dill pickle, approximately four inches long, contains 16 calories, and very little fat. It also has 0.81 grams of protein, 3.5 grams of total carbohydrates, 1.5 grams of dietary fiber, 124 mg of potassium, and 57 mg of calcium.

For additional information:
Pickle Packers Intl. Inc.
(202) 331-2456
Website: www.ilovepickles.org

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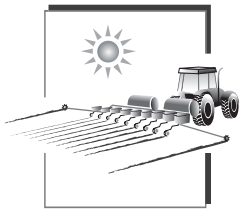
Pickling Cucumber Activity Sheet

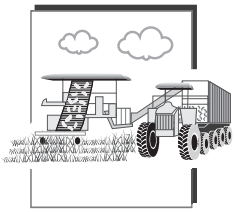
From Plant to Pickle

1



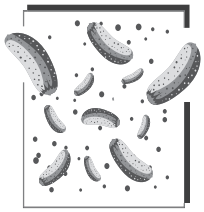
Cucumber planting takes place from March to August.

2



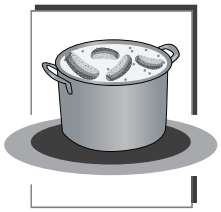
Mechanical harvesting takes place from May to November.

3



Perfect cucumbers are selected for pickling based on size, shape, and color.

4

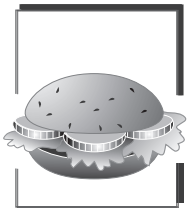


Cucumbers are processed in a brine bath of vinegar, salt, garlic, and spices for 6 to 8 weeks.

5

Additional seasoning is added and pickles are packaged and ready to be shipped to stores and restaurants.

6



Ready to eat! Enjoy pickles on your sandwiches or hamburgers!

Lesson Ideas

- Illustrate and label postcards with the scientific names of various fruits and vegetables.
- Grow cucumbers in your classroom. Observe and plant outdoors when ready.
- Study bees and pollination and their importance to cucumbers and other fruits and vegetables.
- Research canning and food preservation; invite a master preserver to your class.
- Illustrate the steps from farm to fork of different commodities that are preserved.
- Create a timeline of the history of cucumbers or other vegetables.
- Create classroom recipes using cucumbers such as infused water, salads, or sandwiches.

Fantastic Facts

1. Pickle fans include: Queen Elizabeth, George Washington, Thomas Jefferson, John Adams, and Selena Gomez.
2. Although most people consider cucumbers a vegetable, it is in fact a fruit.
3. Miniature sweet or kosher dill pickles are called gherkins.
4. People have been pickling food for nearly 5,000 years.
5. Pickled cabbage is called sauerkraut.
6. Fifty percent of cucumbers grown in the U.S. are made into pickles each year.
7. During WWII, pickles were rationed and 40% went to the armed forces.
8. Pickle juice can be made into pickle popsicles!

Lesson Plan: Refrigerator Pickles

Introduction: Pickling is one way to preserve food. By adding vegetables to a brine bath (vinegar, salt, and seasoning) and allowing time, vegetables can last longer. Discuss why food is preserved, different methods of food preservation (examples: canning, freezing, drying, pickling, dehydrating), and different types of foods that are preserved.

Objective: Students will learn and report on the process of food preservation by pickling.

California Standards: CC ELA: SL.3-12.4, RST.6-12.3
NGSS: MS-LS1-5, HS-LS1

Materials: recipe, cutting board, paper towels, bowl, knife, 3-4 pint jars, lids, labels, marker, measuring cup and teaspoon, vinegar, water, mustard seed, peppercorns, kosher salt, fresh or dried dill, cucumbers.

Procedure:

1. Prepare a sample ahead of time to show your students. Ask students to bring in supplies. Students will work in groups of three to four.
2. Discuss food safety – washing hands, vegetables, and tools. Discuss how to handle kitchen tools safely.
3. Gather materials for a demonstration on how to prepare the pickles.
4. Wash and dry cucumbers and dill. Slice cucumbers into wedges. Place the cucumbers in a bowl with the dill and salt, mix by hand.
5. Using 3-4 pint-size jars, divide the remaining ingredients (vinegar, water, mustard seed, peppercorns) evenly into each.
6. Equally distribute the dill/salt/cucumber mixture to each jar.
7. Seal the lids, mix the pickles, and refrigerate at least a week before you eat them. Have a pickle tasting.
8. Have student groups report to the class on their experience making and tasting pickles.
9. Extension idea: research the role of bacteria in preserving food and the health benefits of preserved food.

Recipe: ½ cup vinegar, 2 cups water, 6 black peppercorns, ½ tsp of mustard seed, 8 tsp kosher salt, 1 cup fresh dill (or 1/3 cup dried), 6 medium cucumbers

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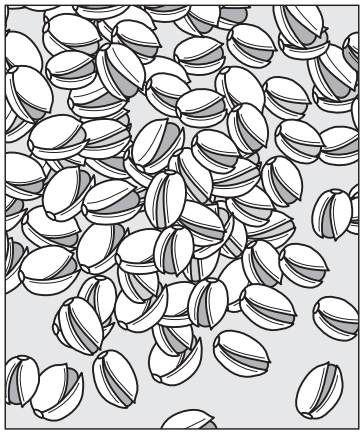
Commodity Fact Sheet

Pistachios

Information compiled by the Administrative Committee for Pistachios

How Produced – Pistachio trees often begin in the nursery where rootstock seeds are planted, germinated, and grown in pots for 15 months. More commonly in recent years, some rootstock trees are grown clonally in sterile cultures inside a laboratory before being grown in a greenhouse. The rootstock is then planted in an orchard to help the tree adapt to soil, climate, and other environmental conditions, before being budded with an edible cultivar (variety). It takes approximately six years after the tree is planted in the orchard before the first harvest. Pistachio trees are either male or female and the pollen is distributed throughout the orchard by the wind. Trees need long, hot, dry summers, and moderately cold winters for optimum yield.



Like other nut trees, the pistachio is alternate bearing—producing a heavy crop one year and a lighter crop the next. Trees reach maturity and peak production after approximately 15 years. Pistachios planted in the Central Valley in the late 1960s are still very productive and, in the Middle East, pistachio trees have been known to produce for more than 100 years.

Pistachio nuts grow in grape-like clusters and an outer skin, called the hull, encases each nut. When ripe, the hull turns rosy and the inside shell splits naturally. Nuts are ready to harvest when the hull slips from the shell with slight pressure. Harvest usually begins in late August and continues until mid-October. California pistachios are mechanically shaken from the tree (in under a minute) and fall directly onto a catching frame. Nuts are then trucked to a processing plant where workers use machines to remove the hull and dry the nut within 24 hours after harvest, ensuring the highest quality standards. Technological advances continue to improve sorting and grading techniques. For example, electric eyes detect color defects and blow the affected nuts away in a jet of air. Further processing may include roasting, salting, and coloring the nut red to meet consumer demand. More than 90% of the pistachios sold are roasted and salted.

History – Pistachios are native to the low mountains and barren, dry foothills in the elevated deserts of Afghanistan, Iran, and Turkey. Historically, they were considered a rare delicacy and a favorite of the Queen of Sheba. Along with almonds, pistachios are the only nuts mentioned in the Bible.

Pistachios were imported to America in the 1880s but did not become popular as a snack food until 50 years later. These nuts were dyed red to draw consumer attention and to cover stains from now obsolete harvesting techniques.

The California pistachio industry can be traced back to 1930 with experimental plantings by American plant scientist William E. Whitehouse, who returned from a six-month trip to Persia (modern day Iran) with 20 pounds of the most distinctive seed he could find. The first commercial crop in California was not harvested until 1976, producing 1.5 million pounds of pistachios.

Varieties – Most California pistachios are of the Kerman cultivar, which originated from seed found in the Kerman region of Iran. Since the state's first plantings, scientists have strengthened the Kerman cultivar by budding it to healthier rootstocks. Several new varieties have been released. The two most widely planted new varieties include Lost Hills and Golden Hills and they make up nearly all the new acres being planted. They are harvested earlier than the Kerman variety and can thrive in warmer climates.

Commodity Value – California leads the nation in pistachio production—it is the sole producer (99% or more) of pistachios. In 2020, an area of 372,000 acres produced 522 million pounds of pistachios and provided California farmers with more than $2.8 billion in returns. In 2020, the U.S. exported 453 million pounds of pistachios with a value exceeding $1.6 billion. Major destinations for export of pistachios were Europe, China, and Canada.

Top Producing Counties – Kern County leads the state in pistachio production with 35% of total state production, followed closely by Fresno County with 29%. Other top producing counties include Madera and Kings.

Nutritional Value – California pistachios provide high-energy nutrients. Each one-ounce serving of shelled pistachios (49 kernels) offers 300 milligrams of potassium, six grams of protein (all necessary amino acids are present), nine grams of total carbohydrates, and three grams of dietary fiber. Pistachios are relatively high in monounsaturated fats (seven grams per serving), which scientists say assist in maintaining good (HDL) cholesterol, while reducing the bad (LDL) cholesterol levels and polyunsaturated fats (four grams per serving). Pistachios have just 1.5 grams of saturated fat per serving, no trans fat, and like all nuts, pistachios contain no cholesterol.

For additional information:
Administrative Committee for Pistachios
(559) 255-6480
Website: www.acpistachios.org

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Pistachio Activity Sheet

The Historical Development of the California Pistachio

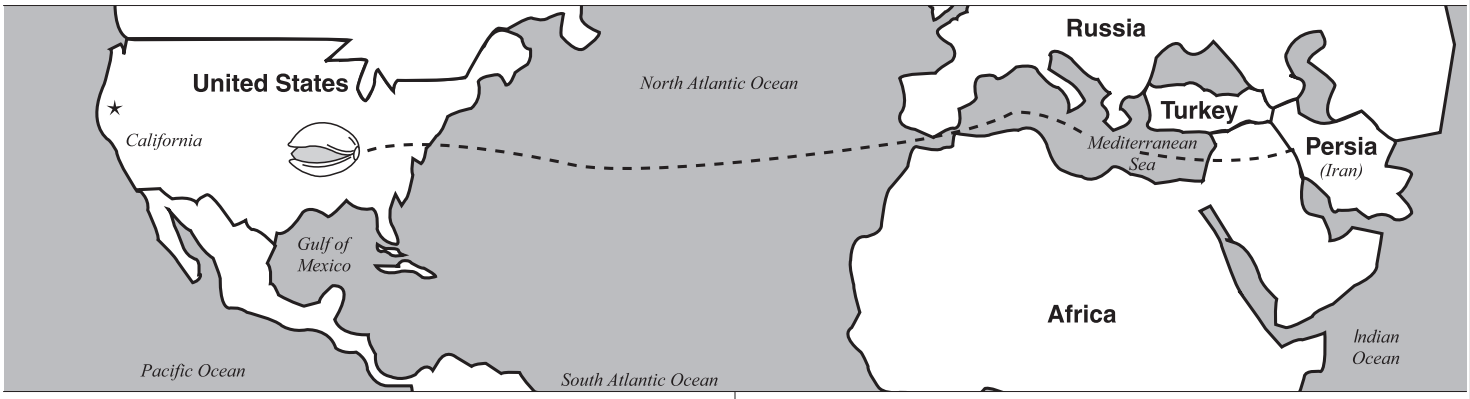
1929—William E. Whitehouse, as instructed by Knowles Ryerson, entered Persia (Iran) to obtain pistachio seeds.

1929-1930—Whitehouse explored Persia and collected 20 pounds of individually selected pistachio seeds, which he took to Washington, D.C.

1930-1950—3,000 trees grew from 20 pounds of seed. However, only one tree proved to be useful.

1950s—The successful pistachio tree seeds were named Kerman for the famous carpet-making city near Rafsanjan in Iran.

2019—More than 740 million pounds of California pistachios were marketed for a value of more than $1.5 billion.



Lesson Ideas

- Create a timeline showing when pistachios were introduced in California and the events that occurred before commercial production began.
- Create a map of California highlighting the major counties where pistachios are grown. Compare and contrast the growing conditions in these counties to the Kerman region of Iran.
- Explore how other countries use pistachios.
- Make pistachio butter. Have a taste test with other homemade nut butter (peanut, walnut, almond).
- Make pistachio creatures. Write a story about your creature.
- Create a flow chart of the life cycle of pistachios.
- Create and prepare a recipe using pistachios.
- Compare the buoyancy of closed and opened pistachios. Discuss how this principle is used in sorting nuts.

Fantastic Facts

1. Pistachio production requires long, hot, dry summers, cold winters, and a breezy spring.
2. It takes 12-24 hours to hull and dry pistachios.
3. California produces 99% of the United States' pistachio crop.
4. The first commercial crop of pistachios in California was not harvested until 1976.
5. It takes approximately 12 years for a pistachio tree to reach peak production.
6. Pistachios resemble grapes while growing on a tree.
7. Approximately 43% of California pistachios are exported.

Lesson Plan: Let's Compare!

Introduction: The agricultural production and economic impact of commodities vary from state to state and country to country.

Objective: Students will compare the production, nutritional philosophy, and economic impact of the pistachio in the Mediterranean to that of the United States.

California Standards: CC ELA: W.3-12.2, W.3-12.7, SL.3-12.4, SL.4-8.5

Materials: World map, access to reference books, encyclopedias, and the Internet, chart paper, markers.

Procedure:

1. Gather various resources students can use in the lesson described below.
2. Discuss with the students that different cultures throughout the world have different eating habits and varying agricultural practices due, in part, to climate, technological advances, and economics. Locate the Mediterranean region on the map.
3. Divide the students into three groups. Each group will compare and contrast the United States to the Mediterranean in one of the following areas:
    - Pistachio production, processing, and harvesting techniques
    - Economic impact of pistachios, including importing and exporting policies and procedures.
    - USDA MyPlate and Mediterranean Diet Pyramid, which vary in the quantities of recommended daily consumption within the various food groups.
4. After the students have gathered information related to their topic, have them write a multi-paragraph report and create a related visual aid. They should use chart paper and markers to make a visual, which can be displayed for others to learn from.
5. Have students share their projects with the class. Take this opportunity to discuss that there are many ways to complete a task or look at subjects such as nutrition.

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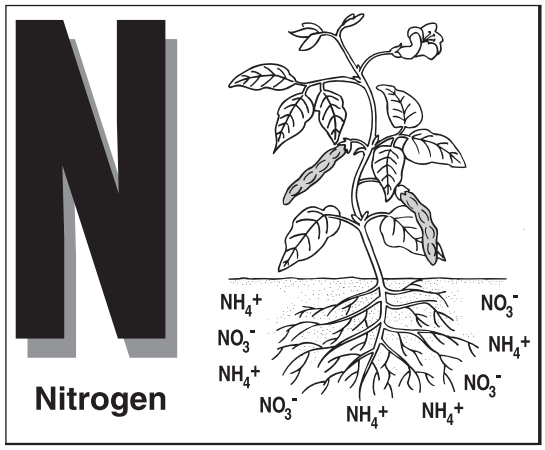
Natural Resources Fact Sheet

Plant Nutrients–Nitrogen

Information compiled by the Western Plant Health Association

Plant Utilization – Nitrogen is one of the 17 chemical elements required for plant growth and reproduction. Nitrogen is in chlorophyll, a green chemical which allows plants to capture energy from the sun and make food for themselves in a process called photosynthesis. It is also the basic element of plant and animal proteins, including the genetic material DNA and RNA, and is important in all phases of plant growth.



Production – Nitrogen is an abundant element on and around Earth. Approximately 78% of the Earth's atmosphere is nitrogen gas (N_2). As with all plant nutrients, however, nitrogen must be in specific forms to be utilized by plants. Converting N_2 into nitrogen plants can use is called nitrogen fixation. Most often, nitrogen gas is converted into plant available nitrogen by using complex chemical processes or nitrogen-fixing bacteria.

Most manufactured nitrogen fertilizers begin as ammonia. At temperatures of 400ºC - 500ºC and great pressure, nitrogen from the air and hydrogen from natural gas combine to produce ammonia. The ammonia can be used directly or further processed into other nitrogen fertilizers. Legumes, such as beans and alfalfa, grow specialized nodules on their roots. *Rhizobia*, nitrogen-fixing bacteria, live in these root nodules and convert atmospheric nitrogen into nitrogen plants can use. Farmers take advantage of this unique symbiotic relationship by periodically growing legumes in nitrogen-deficient soil to naturally boost nutrient levels.

Forms – In the soil, nitrogen exists in different forms, which interact with one another and with plants, animals, and microorganisms. Most crops use nitrogen rapidly, therefore, farmers and home gardeners often supply nitrogen to the plants in a variety of ways, including the application of manufactured fertilizers, applying composts and manures, and growing legumes in rotation with other crops.

Plants absorb nitrogen in the forms of nitrate (NO_3^-) or ammonium (NH_4^+) ions, both of which are water-soluble. Nitrate ions are absorbed quickly by plant roots, but leach easily. Ammonium ions are attracted to soil particles and move slowly through the soil to plant roots. Commercial fertilizers, both dry and liquid, are available with various combinations of nitrate and ammonium ions, enabling farmers to manage their nitrogen application. Crop advisors monitor crops to ensure the crops receive optimum amounts of nitrogen.

History – Americans have fertilized their crops with nitrogen for centuries. Early colonists used animal manure, fish scraps, cottonseed meal, and tobacco stems as nitrogen fertilizer. Later, Americans imported nitrate of soda from Chile, rotated crops with legumes, and used ammonium sulfate–a by-product of steel production. Many of these are still used today.

The process of synthesizing ammonia is considered one of the greatest chemical engineering feats of all time. The process was first demonstrated in the laboratory in 1884, but it was not commercially feasible until 1913 in Germany. The first American ammonia plant was built in 1921. Nitrogen fertilizer production was minimal until after World War II, when the demand for food increased with an increase in human population. Improved nitrogen management is the focus of intensive research at both public and private research facilities.

Top Producing Regions – China is the world's largest producer of nitrogen and phosphate fertilizers and Canada produces more potash fertilizer than any other country. Although the U.S. is the third largest producer of nitrogen fertilizers, we still import more nitrogen fertilizer than any other country. Natural gas is a major feedstock for production of ammonia. During this same period, 27 U.S. ammonia plants closed. Since 2008, four new ammonia plants have opened but the U.S. remains dependent on nitrogen imports. More than 60% of imported anhydrous ammonia is from Trinidad. Globally, wheat receives the largest share of nitrogen fertilizer at 18%, however, in the U.S. nearly half (49%) of all nitrogen fertilizer is applied to corn.

Economic Value – Fertilizer manufacturers, wholesalers, importers, brokers, retailers, and the businesses that serve them support 487,000 American jobs with a total annual economic impact of $130 billion. The fertilizer industry creates over 30,000 jobs in California, paying workers more then $2 billion in wages. Fertilizer, which is responsible for half of the world's food supply, helps keep U.S. farmers profitable by helping them grow in excess of $366 billion worth of crops every year.

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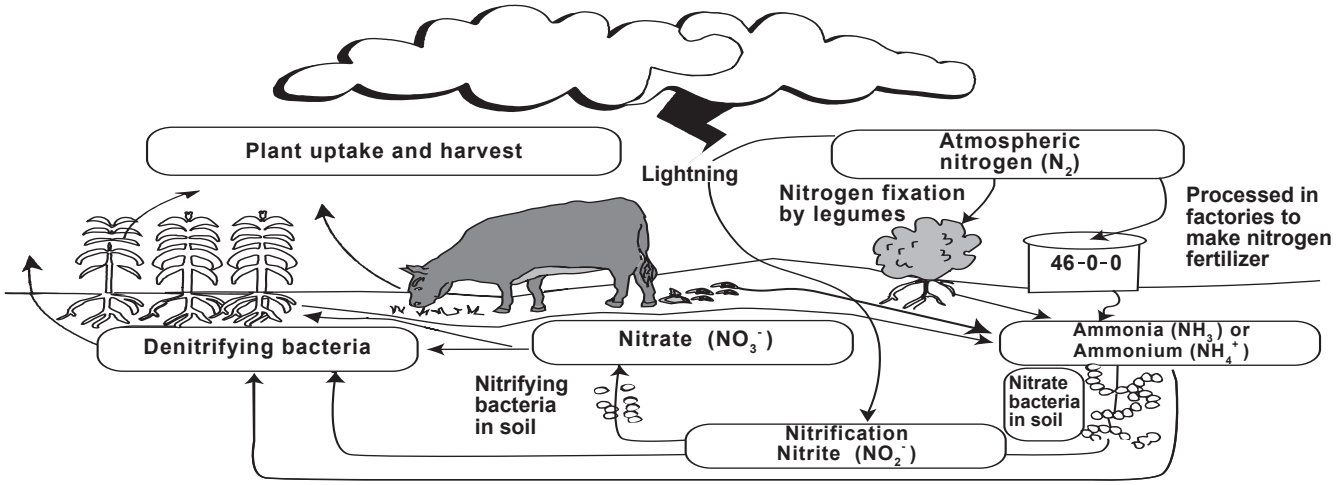
Nitrogen Activity Sheet



Lesson Ideas

- Compare and contrast the nitrogen and water cycles.
- Make a poster of the nitrogen cycle using magazine pictures.
- Chart and compare the growth of plants which are fertilized with varying amounts of nitrogen fertilizer.
- Compare fertilizer labels for nitrogen content.
- Make compost at your school using garden, fruit, and vegetable lunch waste.
- Identify plants which are legumes. Research how these plants make nitrogen available to other plants.
- Draw a picture of a plant and the plant's need for nitrogen.
- Research the procedures and chemical equations used in ammonia fertilizer production.
- Compare and contrast the nitrogen content of various organic fertilizers, including steer manure, chicken manure, and fish emulsion.
- Locate nitrogen on the periodic table of elements. Learn about its physical and chemical properties.

Fantastic Facts

1. Ammonia is the basic chemical ingredient in commercial nitrogen fertilizer production.
2. The color green is associated with plants which contain a sufficient amount of nitrogen.
3. Legumes, such as beans and alfalfa, contain microorganisms in their roots that convert nitrogen into a form other plants can use.
4. NO_3- and NH_4+ are the two forms of nitrogen that plants can absorb through their roots.
5. The United States is the world's top importer of nitrogen.
6. Nitrate (NO_{3-}) is a form of nitrogen that can leach rapidly, depending on environmental factors.

Lesson Plan: Let's Make Manure Tea

Introduction: Substances added to improve the nutrient content of soils are called fertilizers. Fertilizers can be natural or man-made (synthetic). Animal waste is sometimes used as a natural fertilizer.

Objective: Students will make a liquid fertilizer called "manure tea" from steer manure. Students will design and perform an experiment to determine the optimum dilution of this nitrogen-rich fertilizer.

California Standards: NGSS: 3-5-ETS1-3, MS-LS1-5, MS-ETS1-3

Materials: Store-bought steer manure (3 or 4 cups), coffee filter, five-gallon bucket with lid, water, string, index cards cut in half, stapler, tablespoon, corn seedlings and other supplies for student-designed experiment.

Procedure:

1. Write the term "manure tea" on the board. Obtain student ideas for its definition. Also discuss that plants need certain nutrients for successful growth and reproduction.
2. Have each student make a manure tea bag by placing two tablespoons of manure into a coffee filter and stapling it shut. Staple a string to one end and 1/2 of an index card to the other end of the string. Have students create and draw labels for their "brands" of tea on the index cards.
3. Hang the tea bags in a covered five-gallon bucket that is full of water. Let the bags steep overnight. Record observations.
4. Design and perform a class experiment that will determine the optimum manure tea concentration for growing corn. Brainstorm variables to control and potential failure points.
5. At the conclusion of the experiment, compare and identify the most successful design solutions. Discuss how their newly-gained knowledge can relate to large-scale agriculture.

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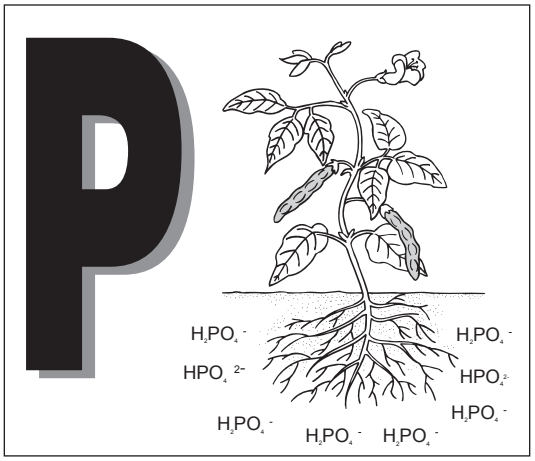
Natural Resources Fact Sheet

Plant Nutrients–Phosphorus

Information compiled by the Western Plant Health Association

Plant Utilization – Phosphorus, one of the 17 chemical elements required for plant growth and reproduction, is often referred to as the "energizer" since it helps store and transfer energy during photosynthesis. It is also part of the genetic material of all cells—DNA and ATP.



All plants require phosphorus during all phases of growth. Most annual plants (plants that grow, reproduce, and die in one year) require large amounts of phosphorus as they begin to grow. Plants grown in cold weather which have limited roots and rapid top growth, such as lettuce, are high phosphorus users. Legumes also require plentiful amounts of phosphorus. Established plants such as trees, shrubs, and vines, require the least amounts of phosphorus fertilizer, especially those grown in warm climates with long summers.

Production – In the soil, phosphorus is often found in chemical forms that cannot immediately be absorbed by plants, so farmers commonly apply phosphorus to the soil. The common source for commercial phosphorus fertilizer is rock phosphate, a calcium phosphate ore found in deposits within the earth. Rock phosphate is usually strip mined and then pulverized. The resulting material is treated with sulfuric, phosphoric, or nitric acid to produce various soluble phosphates that can be used as fertilizers such as monoammonium phosphates, diammonium phosphates, and super-phosphates.

Forms – All plants require phosphorus. Plants most often absorb phosphorus in the form of phosphate ions $H_2PO_4^-$ and sometimes as HPO_4^{2-}. These phosphate ions react readily with the soil and become part of the soil particles in a process called "fixation." Fixation prevents the leaching of phosphorus, but also changes it to a form that plants cannot use. The challenge in agriculture is to provide plants with the proper amount of phosphorus, in the proper form, at a time when the roots will absorb it.

The phosphorus concentration in fertilizer is reported as P_2O_5 and is represented by the middle number of the three numbers listed on the label. Manufactured fertilizers come in liquid and granular forms. Organic fertilizers, such as manure, contain phosphorus in limited quantities. Growers usually apply phosphorus directly near the root zone. This is called banding and makes the phosphorus available for immediate absorption by the roots. Growers often mix phosphorus in soil when planting seedlings or transplanting trees, shrubs, or vines.

History – Early American farmers used ground bones as fertilizers, however, very little of the phosphorus in the bones was available to the plants. In 1808, Sir James Murray of Ireland produced the first effective phosphorus fertilizer. Murray treated bones with sulfuric acid, converting the phosphorus to phosphate, a form of phosphorus plants can absorb. Murray later discovered that rock phosphate could be used in this same process.

Super phosphate production began in the United States in South Carolina in 1849. In 1851, John Jay Mapes of Long Island, New York, built the first phosphate manufacturing plant in the United States. Thus, he earned the title of "Father of the American Fertilizer Industry." By 1889, America produced 90% of the world's phosphate fertilizer and continues to produce 30% of the fertilizer produced today.

Top Producing Regions – China leads the world in phosphate production, followed by Morocco, and the U.S. The U.S. remains the leading exporter of phosphate fertilizers. In 2009, China led all countries in annual phosphate fertilizer consumption with 10 million metric tons, followed by India which consumed more than five million tons, and the U.S. with more than four million tons. In 2007, Florida and North Carolina accounted for 85% of the total domestic output of phosphate rock. Production also occurs in Idaho and Utah. India and China are the major destinations for United States exports of phosphate fertilizers.

Economic Value – Fertilizer manufacturers, wholesalers, importers, brokers, retailers, and the businesses that serve them support 487,000 American jobs with a total annual economic impact of $130 billion. The fertilizer industry creates over 30,000 jobs in California, paying workers more then $2 billion in wages. Fertilizer, which is responsible for half of the world's food supply, helps keep U.S. farmers profitable by helping them grow in excess of $366 billion worth of crops every year.

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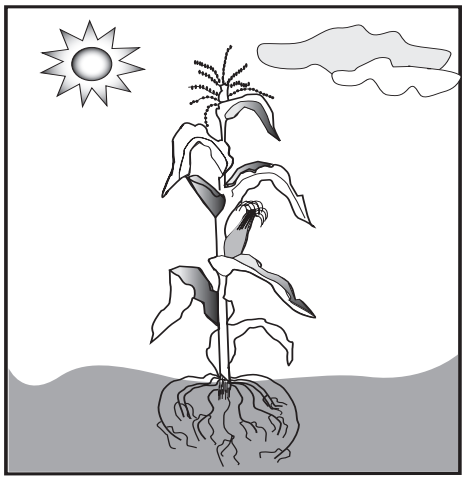
Phosphorus Activity Sheet

How Phosphorus Functions in Plants

- *Stimulates early growth and root formation and growth.*
- *Necessary for cell division and DNA and RNA formation.*
- *Improves the ability of plants to absorb water and other nutrients.*



- *Stimulates flower blooms and seed development.*
- *Improves plant strength and the ability to tolerate unfavorable environmental conditions.*
- *Aids in photosynthesis and food formation.*

Lesson Ideas

- On a United States map, color the states yellow that mine rock phosphate.
- Learn about the physical and chemical properties of phosphorus.
- Research and list foods high in phosphorus and learn how phosphorus is used in the human body.
- Interview a nursery or greenhouse worker and ask when and how phosphorus should be applied to your favorite plants.
- On a world map, color the major phosphorus producers one color and the major phosphorus importers another.
- Research how phosphorus rock is processed into phosphate fertilizer.
- Invite farmers into your class to discuss how plant nutrients are added to their particular crops.
- Create a comic strip whose main character is “Phosphorus—the Energizer.”

Fantastic Facts

1. Plants require the most phosphorus at the beginning of life and during periods of rapid growth.
2. The largest phosphorus producer is China.
3. Plants that have small root systems and significant above ground growth require plentiful amounts of phosphorus fertilizer.
4. Before rock phosphate, ground bones mixed with dilute sulfuric acid provided plants with phosphorus.
5. Florida and North Carolina produce the most rock phosphate in America.
6. P is the symbol for the element phosphorus.
7. The middle number on a fertilizer label represents the amount of phosphorus it contains.

Lesson Plan: Read the Label

Introduction: Fertilizer labels have a standard format which lists three numbers. Each number represents the quantity of a nutrient in the fertilizer. The first number represents the percentage of nitrogen (N) in the particular fertilizer. The second number represents percentage of phosphorus (P_2O_5), and the third number represents percentage of potassium (K_2O) in the fertilizer.

Objective: Students will examine fertilizer labels, research the nutrient needs of an agricultural crop, and create a fertilizer label for that crop.

California Standards: CC ELA: SL.3-12.3; NGSS: 5-LS1-1, MS-LS1-5

Materials: Fertilizer labels, white paper, markers, reference books.

Procedure:

1. Distribute sample fertilizer labels. In groups, have students examine the labels. As a class, create a template for a standard fertilizer package. Discuss what the three numbers mean on the front label.
2. Have each student select a crop for which they will find out its nutrient requirements. They may use encyclopedias, the Internet, a local agricultural commissioner’s office, or information from the University of California Cooperative Extension.
3. Have students create fertilizer labels that would meet the nutritional needs for their crop. Students may need to specify the time frame for application, such as “at planting.”
4. As a class, compare the fertilizer labels the students developed. Could one fertilizer be used for more than one commodity? Discuss what other factors might be considered when determining what fertilizer to purchase—price per unit, package size, soil type, climate, availability of composts and manures.
5. Invite an agronomist or fertilizer manufacturing representative to your class to discuss the uses and sales of fertilizers. After the presentation, identify the speaker’s claims, point of view, and reasoning.

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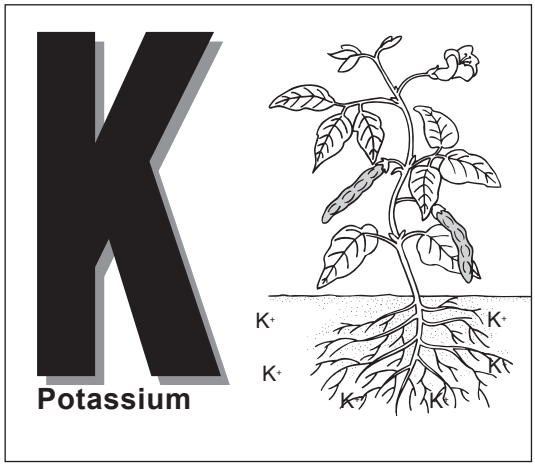
Natural Resources Fact Sheet

Plant Nutrients–Potassium

Information compiled by the Western Plant Health Association

Plant Utilization – Potassium, one of the 17 chemical elements required for plant growth and reproduction, is often referred to as the "the regulator" since it is involved with more than 60 different enzyme systems in plants. Potassium helps plants to resist drought and effects from excessive temperatures. It also increases crop resistance to disease. Potassium aids plants in the production of starches, controls root growth, and regulates the opening and closing of pores in plant cells (called stomata), which is important for efficient water use.



All plants require potassium, especially crops high in carbohydrates, like potatoes. Studies have shown that adequate amounts of potassium may promote the growth of long, strong cotton fibers; increase the shelf life of fruits; increase the stem length and quantity of roses; enhance the green color and growth of turf grass; and increase the size and quality of fruits, grains, and vegetables.

Production – Potassium is the seventh most abundant element in the Earth's crust, yet only one to two percent is available to plants. The rest is incorporated in the structure of the rocks and unavailable to plants. Farmers often apply potassium fertilizer for optimum plant growth.

Most potassium is mined from underground deposits and is shaft mined, like coal. Some shafts are drilled as deep as 3,000 feet. In some cases, solution mining is also used in which case water is pumped into the shaft to dissolve the ore. The solution is extracted and allowed to evaporate, leaving behind potassium salts. Some potassium comes from the evaporation of water from natural salt lakes, such as the Great Salt Lake in Utah, and the Dead Sea in Israel and Jordan. Tobacco stems, wood ash, wool waste, sugar beet factory waste, and flue dust also contain potassium, but their use as a fertilizer is limited.

Forms – Potassium is symbolized as K_2O on fertilizer labels and is the third number on the label. Plants absorb potassium in the form of the ion K^+ which dissolves readily in water.

Ninety-five percent of all potassium fertilizers come in the form of muriate of potash, also known as potassium chloride. For crops unable to tolerate chloride, other chloride-free salts such as potassium sulfate and potassium nitrate are used. Potassium comes in both liquid and granular form and is usually mixed in the soil or placed directly near the root zones of plants. Application of chloride-free foliar sprays are sometimes used on certain crops.

History – The letter K, used to symbolize potassium, comes from the German word kalium. Before the industrial era, people burned wood and other organic matter in pots to manufacture soap. The ashes were rinsed and the water was allowed to evaporate, leaving a residue of potassium salts. People called the residue "pot ashes" or potash. These salts were boiled with animal fat to produce soap.

In 1868, Samuel William Jackson, a botanist in Connecticut, burned plants and analyzed the ash. Jackson found plants consisted of large amounts of potassium and other minerals. His work led to the use of fertilizers to promote an increase in crop yields. The very first U.S. patent issued by the United States government was for an improved method of potash production.

Top Producing Regions – Canada is the world's largest potash producer. Russia, Belarus, and China are also top producers of potash. U.S. production has been stable with most domestic production occurring in New Mexico. Lesser amounts are produced in Utah and Michigan. The price of potash fertilizer has increased significantly in the past few years, causing mining companies to seek new sources of the raw material throughout the world.

China is the world's leading potash consumer. Brazil and the U.S. are the next leading consumers of potash. Approximately 20% of the 6.5 million tons of potash used in the U.S. is domestically produced.

Economic Value – Fertilizer manufacturers, wholesalers, importers, brokers, retailers, and the businesses that serve them support 487,000 American jobs with a total annual economic impact of $130 billion. The fertilizer industry creates over 30,000 jobs in California, paying workers more then $2 billion in wages. Fertilizer, which is responsible for half of the world's food supply, helps keep U.S. farmers profitable by helping them grow in excess of $366 billion worth of crops every year.

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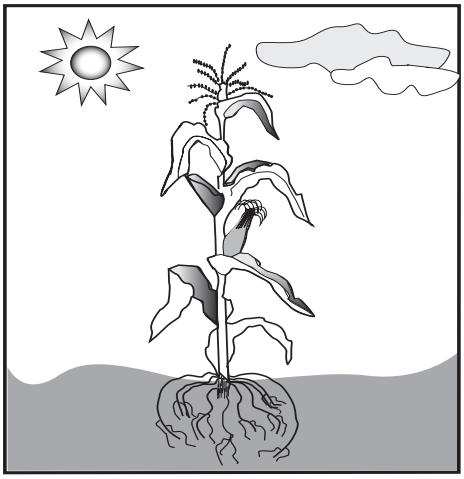
Potassium Activity Sheet

How Potassium Functions in Plants

- *Helps slow crop diseases.*
- *Builds cellulose needed for stalk and stem strength.*
- *Aids in photosynthesis and food function.*
- *Increases root growth and improves drought resistance.*



- *Produces grain rich in starch.*
- *Necessary for plant protein formation.*
- *Reduces water loss and wilting.*
- *Assists many enzyme actions.*

Lesson Ideas

- On a world map, color the major potassium exporters blue and the major importers red.
- On a map of North America, locate and color the areas where potassium is mined.
- Research how humans utilize potassium and find out what foods are high in potassium.
- Make a poster illustrating the various roles potassium plays in plant growth and health.
- Locate potassium on the periodic table of elements. Learn about its physical and chemical properties.
- Find two points that are 3,000 feet apart so students can appreciate the depth of some potassium mine shafts.
- Research the Colonial soap-making process and the various uses of potash.
- Find out how agronomists determine the potassium content of soils.

Fantastic Facts

1. Canada is the world's leading exporter of potassium.
2. Potassium is obtained by underground mining.
3. Potassium is sometimes called "the regulator" because it controls many plant enzyme systems.
4. Potassium helps plants by aiding protein and starch formation, stimulating root growth, providing winter hardiness, and opening and closing cell pores called stomata.
5. New Mexico processes the most potassium in the United States.
6. Historically, potassium was called "potash" because it was sourced from the residue found in wood ashes.
7. California is the largest importer of potassium.
8. Some potassium is obtained from The Great Salt Lake in Utah.
9. The very first U.S. patent issued was for an improved method of potash production.

Lesson Plan: The World of Potassium

Introduction: Potassium is an essential nutrient for plants and animals. It also has many other uses, depending on its chemical formulation.

Objective: Students will research potassium and its various uses. They will create a wall-length mural that depicts their findings.

California Standards: CC ELA: W.3-12.7; RI.3.5; RI.4-5.9; RST.6-10.2, 7

Materials: Reference materials, including encyclopedias, human nutrition books, plant nutrient requirement books, butcher paper, paint or markers, glue.

Procedure:

1. Write the following phrases on index cards: plants which produce fibers for clothing; annual crops, such as celery; forage crops, such as alfalfa; tubers, such as potatoes; disinfectant; human nutrition; component in soap; plant guard cells; potassium forms which are usable by plants; agricultural by-products which contain potassium; roses and other flowers.
2. Divide the students into groups of three or four and distribute one index card to each group.
3. Each group is responsible for researching how potassium relates to the key words on the index card. After they gather the details, the group is to decide how they will depict their knowledge on a wall mural called "The World of Potassium."
4. In a class discussion, determine what the class mural will look like so that all aspects of potassium use will be displayed.
5. Have each group create their graphics and text for the mural and then place it on the mural.
6. Display the mural at a science night or in the library. This may be displayed with other murals made for other elements, such as nitrogen and phosphorus.

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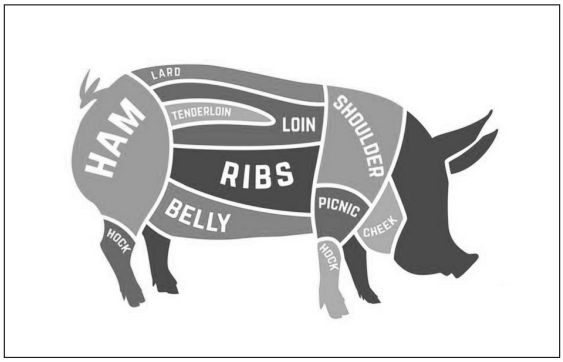
Commodity Fact Sheet

Pork

Information compiled by California Pork Producers Association

How Produced – While a majority of California farms use modern farming practices, some farms are specific niche markets. Today's farming combines the best of traditional farming practices with the benefits of modern technology. Many California farmers believe that raising pigs in barns helps them to better care for their animals by controlling their environment. Many California pigs are raised in barns that use technology like fans and heaters to keep them comfortable all year long. Pigs are kept in clean living conditions and provided fresh feed and water. Most pigs eat a diet that consists of corn and soybeans and is called a ration. Nutritionists carefully develop pig rations based on the age, size, and nutrient requirements that changes throughout their lifetime. Pigs have stages of growth from birth to market: farrowing, weaning, growing, and finishing. Baby pigs are raised by their mother or sows, for the first month, then they are weaned. Weighing between 12-15 pounds, they go to a nursery where they are fed solid food, provided fresh water, and kept warm. They stay there for four to six weeks and are fed a grower ration. They will complete their growth cycle at an average market weight of 270 pounds around six months of age.



History – There are fossils indicating wild pig-like animals roamed the earth 40 million years ago. Pigs were domesticated in China around 4900 BC and were raised in Europe by 1500 BC. Columbus took pigs on his trip to Cuba in 1493. Spanish explorer Hernando de Soto, the "father of the American pork industry" was the first person to bring pigs to America in 1539. With just 13 pigs he settled in Florida. Once in America, de Soto's pig herd grew to 700. Explorers used the pigs not only for eating as fresh meat but for salt pork and preserved pork. When de Soto died, some pigs ran off and became ancestors to today's feral or razorback pigs and some were given to Native Americans as gifts. The pork industry in America had begun. Pig production spread quickly through the colonies. Hernán Cortés brought hogs to New Mexico in 1600 and Sir Walter Raleigh brought sows to Jamestown Colony in 1607. As pioneers moved west, they took their pigs with them in crates that hung from covered wagons. Pork processing facilities started popping up in major cities. Pigs were first processed in Cincinnati, which became known as "Porkopolis."

Varieties – There are two major forms of domestic pigs, European (Sus scrofa) and Asian (Sus indicus). Chinese pigs were bred for superior meat quality and adaptability. In European pigs, fatness was selected for. The genetic crossbreeding of these two varieties in the 18th and 19th centuries formed a broad genetic basis for today's domestic pig. There are over 180 species found in every continent of the world except Antarctica. The top eight breeds are Yorkshire, Hampshire, Berkshire, Landrace, Duroc, Chester White, Poland China and Spot. In California, crossbreeds are the most desirable animal in weight, conditioning, and carcass quality.

Commodity Value – In 2021, California ranked 28th in the United States in pork production with an inventory of 82,000 pigs valued at over $13 million dollars annually. Although California makes up less than one percent of the total U.S. pork production, it accounts for 13% of the national pork consumption. The U.S. is the third largest producer and consumer of pork and pork products globally, exporting over five billion pounds of pork annually. Pork production and pig prices vary in a predictable manner during the calendar year. Such variation is called seasonality or seasonal variation.

Top Producing Counties – There are four top processing plants that are located in the counties of Los Angeles, San Joaquin, Glenn, and Merced providing more than 11,000 animals per day. Many swine operations provide breeding pigs, project pigs, roaster pigs, and/or products and services for sale. Pigs are raised in every county in the state. Many agriculture colleges like CSU Fresno, CSU Chico, Cal Poly SLO, UC Davis, Modesto Junior College, and Reedley College breed, raise, and sell pigs.

Nutritional Value – A 3-ounce portion is an excellent source of protein, thiamin, B6, phosphorus, and niacin, and a good source of potassium, riboflavin, and zinc. It contributes six percent of the calories in a 2,000 calorie diet. Pork is 16% leaner and has 27% less saturated fat than 20 years ago due to improved breeding and feeding methods, as well as advancements in processing.

For additional information:
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California Pork Producers Association

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Pork Activity Sheet

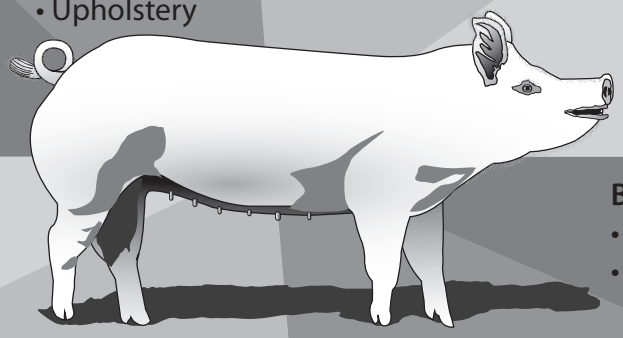
PORK BY-PRODUCTS

FATTY ACIDS AND GLYCERINE
- Weed killers
- Crayons and chalk
- Make-up
- Fabric softener

HAIR
- Artist's brushes
- Upholstery

BRAIN
- Cholesterol

SKIN
- Gelatin
- Footballs
- Luggage, purses, gloves and shoes
- Drumheads



BONES
- Glue
- Buttons
- Fertilizer
- Water filters

BLOOD
- Plywood adhesive
- Fabric printing and dyeing

MEAT SCRAPS
- Commercial feeds
- Pet food

INTERNAL ORGANS
- Insulin
- Heart valves

Lesson Ideas

- Research the changes in pig production in the last 50 years and explore why pigs have larger litters, use less water, and produce less waste.
- Compare pig operations in the Midwest with California. Why are there more? Are they bigger?
- Identify and illustrate the top eight breeds of pigs.
- Research heritage breeds of pigs and the history of their domestication. Create a timeline.
- Research marinades. Do an experimental taste test on meat that has been marinated and meat that has not been.
- Create a recipe using pork and a nutritional brochure. Share with the class.
- Study the process of ear notching and identify how to read a pig's number.
- Research the history of using pig by-products to create insulin. Research other animal/medicine connections.
- Create a cartoon panel that follows a pig's journey through their four phases of life from birth to market.

Fantastic Facts

1. A gilt is a female pig that has not given birth; a sow is a female pig that has given birth.
2. Farrowing is the act of giving birth to baby pigs.
3. Sows generally have litters of 12 and can have two litters per year.
4. Pork is the world's most widely eaten meat followed by chicken and beef.
5. Pig heart valves can be surgically implanted in humans to replace weakened heart valves.
6. When hot dogs were first sold, street vendors called them 'red hots,' and they didn't come on a bun. Instead, a pair of white cotton gloves came with each to keep fingers cool while eating.
7. Like humans, pigs are omnivores, meaning they eat both plants and animals.
8. Pigs don't have sweat glands. That is why they like to roll around in the cool, wet mud.
9. Wall Street was once a long solid wall constructed on Manhattan island to control roaming herds of wild pigs.

Lesson Plan: "Living High on the Hog" and other idioms

Introduction: Idioms are sayings that offer advice. They mean something different than what they literally mean. For example, "Living High on the Hog" means to be wealthy or "when pigs fly" means never or unlikely to happen.

Objective: Students will create and illustrate an idiom book.

California Standards: CC ELA: L.4-12.5

Materials: Idiom examples, paper, pencils, crayons, blank paper.

Procedure:

1. Read and discuss different idioms and their origin.
2. The following examples are a good place to start the class discussion:
   - It's raining cats and dogs.
   - A penny for your thoughts.
   - Barking up the wrong tree.
3. Have students brainstorm in small groups to share common idioms they have heard or used.
4. Research the history and meaning of each idiom.
5. Choose the idioms discovered by the students and create a classroom book that includes the idioms, illustrations, real meanings, and history.

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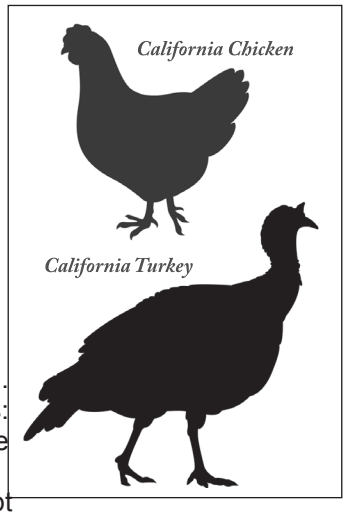
This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Poultry

Information compiled by the California Poultry Federation

How Produced – Turkeys and chickens are raised on ranches throughout the state. Turkeys are the result of 18 months of careful effort. First, eggs are purchased from a "primary breeder" who specializes in producing superior genetic stock. In 28 days, they hatch into potential breeders. Those that pass a rigorous selection process are placed in a breeding program that produces market turkeys. After hatching, the turkeys are ready for market in four to five months.



Raising chickens for market is much faster. Incubation takes only 21 days. Eggs are placed in an incubator, located in a chick hatchery. After hatching, they are counted and graded before delivery to the customer's farm. There are two types of egg laying chickens: the meat-type breeder and the egg-type breeder. Chicks raised for meat are ready in 40 to 45 days. Hens kept for egg laying are kept in production for 44 to 60 weeks before being sold to market.

History – The first known domesticated poultry are believed to be the red jungle fowl, a member of the pheasant family, which lives in the forests and bamboo jungles of India and Southeast Asia. Jungle fowl were captured and kept for their eggs and for meat by about 2000 B.C. in Asia. It is thought that all domestic poultry in the world today are descended from this one species.

Over the past 100 years, poultry production has grown from backyard flocks and small, local businesses into highly efficient businesses. In the 1800s and early 1900s many families had backyard flocks for eggs and for meat. By the 20s and 30s, the broiler chicken evolved, and was raised specifically for its meat. In the 40s, 50s, and 60s, feed mills, hatcheries, farms, and processors were still all separately run businesses. Vertical integration began in the mid-1960s, meaning poultry businesses operated all aspects from growing chicks to transporting the finished product. In the late 60s and early 70s, television and media began to market chicken under brand names. Today, most California poultry is sold under a few family-owned farms.

Varieties/Breeds – More than 300 breeds of chickens exist but only a few are appropriate for meat-type commercial production. Common breeds include New Hampshire, White Plymouth Rock, Cornish, or hybrid strains developed by combining breeds to meet producers' needs.

Turkeys have roamed North and South America for 10 million years. Wild turkeys still exist but they are not very similar to the tender, broad-breasted bird seen in the market. These birds weigh three and a half times as much as the wild turkeys eaten by the Pilgrims. Today's turkey consumes 30% less feed and requires one month less growing time to reach market weight than turkeys did 40 years ago. The most common commercial turkey comes from strains developed over the years to produce a white, broad-breasted turkey.

Commodity Value – The U.S. poultry industry produced chickens, turkeys, eggs, squab, and game birds for a combined value of more than $100 billion. In California, this industry is valued at $8 billion. In 2019, California chicken producers raised more than 275 million birds, which ranks California among the top 10 chicken producing states. California turkey producers raised more than 14 million birds ranking turkey within the top eight states. California is the top squab producing state. California chicken companies process more than 800,000 chickens per day and more than 760 different California chicken products are sold in supermarkets and grocery stores throughout the West.

Top Producing Counties – The Central Valley is the primary poultry producing area. Fresno, Merced, Stanislaus, San Joaquin, and Sonoma are top producing counties for chicken. Stanislaus, Fresno, Merced, Kings, and San Joaquin are top producing counties for turkey. These rural areas allow room for ranches while allowing access to quick and economical transportation to market.

Nutritional Value – Poultry is in the protein food group and provides nutrients that are important for your body. Nutrients include B-vitamins (niacin, thiamin, riboflavin, and B-6), vitamin E, iron, zinc, and magnesium. Turkey and chicken are low in fat and calories while providing a high-protein meat source.

For Additional Information:
California Poultry Federation
(209) 576-6355
cpif.org
nationalchickencouncil.org
eatturkey.com

California Poultry Federation

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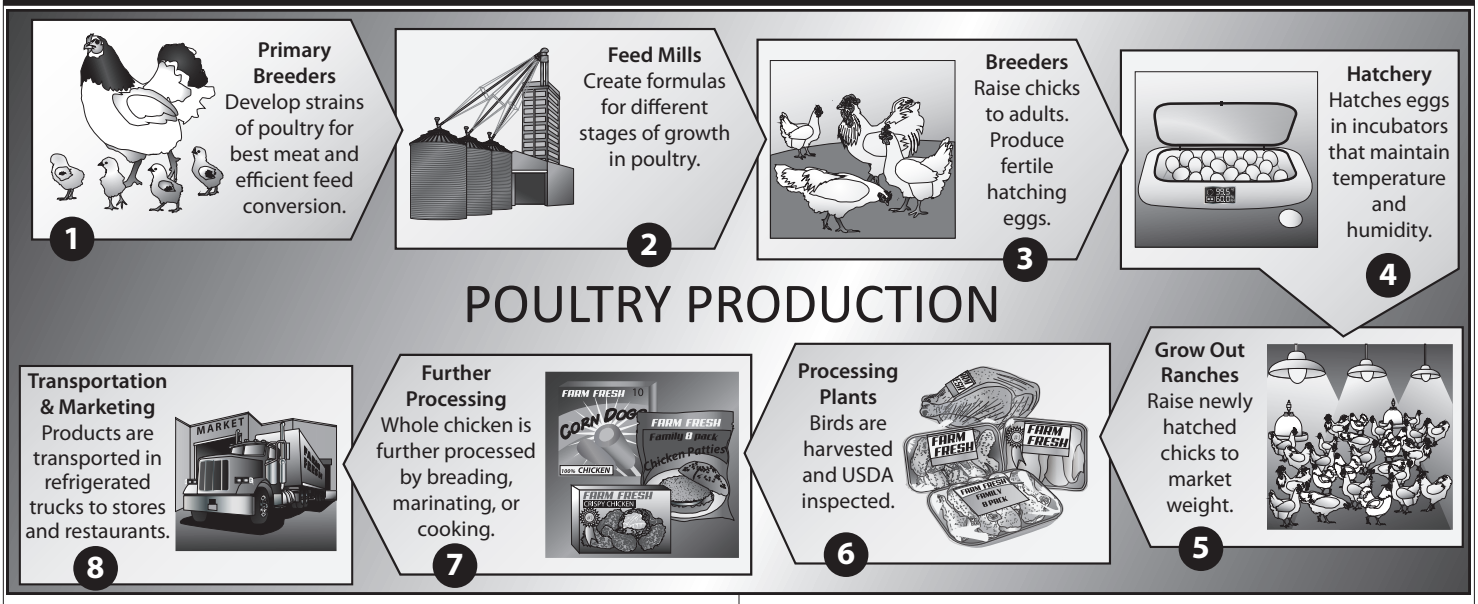
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Poultry Activity Sheet



Lesson Ideas

- Create a timeline and give a presentation on poultry history.
- Create a Jeopardy poultry game.
- Research and compare the nutritional value of poultry with other meats.
- Research and identify different breeds. Compare their qualities and create a card set.
- Create a Thanksgiving or poultry dinner meal, identify the origin of each food.
- Research and compare other vertically integrated businesses.
- Graph the production of broilers or turkeys month-by-month for a year and discuss how production reflects seasonal demand.

Fantastic Facts

1. About 20,000 people work for California's poultry companies.
2. It takes about 10 pounds of feed to produce a five pound market-ready chicken.
3. California's poultry companies are all family-owned.
4. Foster Farms produces 700 million corn dogs per year.
5. Most corn dogs are made from chicken.
6. California consumers eat more chicken than any other state, more than 3.5 billion pounds per year. That's about 30 chickens per person!
7. Most chickens and turkeys are produced in California's Central Valley.
8. The chicken and turkey you eat today is thought to be descended from India and Southeast Asia.

Lesson Plan: Taco Tuesday Taste Test

Introduction: Tacos can be a fun way for students to discuss the flavors of chicken and turkey. This lesson will allow students to have a taco party and learn along the way.

Objective: Students will work in groups to create an advertisement, calculate the cost of each taco, and conduct a taste test to determine the best ingredient combinations.

California Standards: CC ELA: SL.4.1, SL.5.1, 4, 5, SL.6-8.1, 4, 5, SL.9-12.1, 4; CC Math: 4.NBT.4, 5, 6; 5.NBT.5, 6, 7; 6.NS.2, 3; 7.NS.1, 3

Materials: Taco ingredients. (flour or corn tortillas, shredded or ground cooked turkey and chicken, grated cheese, sour cream, salsa, lettuce, tomatoes, and other selected ingredients) serving utensils, plates, napkins, large construction paper for advertisement posters, colored paper, markers, and scissors.

Procedure:

1. Introduce the taco taste test with your class. Brainstorm popular ingredients to include in a taco. Students sign up to bring different ingredients. Have students save all receipts and record costs on a classroom chart for all groups to use.

2. In groups, students compete to create the best taco, and calculate how much it costs per taco.
3. Have each group create and present a commercial for their taco.
4. Finish with a taste test competition to select the class favorite.
5. Additional ideas: students learn what food group each ingredient comes from, the serving size, and the nutritional value.

Suggestions:

- Fill a corn tortilla with cooked ground turkey, shredded lettuce, diced tomatoes, shredded cheddar cheese, and sliced olives. Drizzle with favorite red or green salsa.
- Layer a flour tortilla with mashed black beans, shredded cooked chicken, shredded cheese, dollop of greek yogurt and favorite red or green salsa. Gently fold in half and enjoy!

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Commodity Fact Sheet

Processing Tomatoes

Information compiled by the California Tomato Growers Association, Inc.

How Produced – Tomato plants are planted in the field as seeds or as young plants, called seedlings. If sowing seeds directly into the ground, the producer sows seeds in late January or early February. If planting by seedling, plants are grown in greenhouses until they are hardy enough to be planted outside in the spring.

Tomatoes are ready for harvest between early July and mid-October. Mechanical harvesters move through the fields picking the entire tomato plant and shaking the tomatoes off the vine. Specially designed electronic sensors on the harvesters sort the ripe, red tomatoes from the vine and transfer them into a gondola pulled by a tractor following alongside. The tomatoes are immediately transported from the fields by trucks, which can hold approximately 50,000 pounds of tomatoes. Trucks haul the crop to a nearby state-controlled grading station to be graded, then on to a tomato processing plant where they are peeled, sliced, diced, or sauced into the familiar canned tomato products seen on store shelves.

History – The first tomatoes can be traced to the South American Andes Mountains where they grew wild as cherry-sized berries. Padres following the Spanish conquistadors most likely sent the first seeds to Spain in the early 1500s. The fruit gained little attention in Spain, but soon traveled to Italy—a country that embraced tomatoes with great passion and developed numerous recipes which are still popular today. By the mid-sixteenth century, tomatoes made their return to America via English colonists. They did not become an important part of the American diet, however, until after World War I. Today, tomatoes are grown in every state except Alaska.

Varieties – There are more than 2,750 genetic varieties of fresh market and processing tomatoes at the Tomato Genetics Stock Center at the University of California, Davis. These varieties have been developed to suit the various growing conditions around the state, taking into account soil type, climate, and disease. Processing tomatoes have been selectively bred for more than 60 years to differ from fresh market tomatoes. The varieties designated for processing have a thicker skin and firmer consistency than fresh market tomatoes. These qualities enable the mechanical harvester to pick the fruit when it is ripe without damaging the fruit and ensure tomatoes can survive transportation. The processors prefer the "meatier" character of the processing tomatoes because it provides consumers with more of the tomatoes' essence.

Commodity Value – California leads the nation in processing tomato production, accounting for 100% of the nation's total. In 2020, California's processing tomato growers grew approximately 228,000 acres, producing 11 million tons of tomatoes valued at nearly $1 billion. Canada is the top export market, valued at $243 million.

Top Producing Counties – As of 2022, Fresno County leads production followed by Yolo, Kings, Merced, and San Joaquin counties. However, nearly the entire state is involved in producing processing tomatoes, with some being grown as far south as Kern County and as far north as Colusa County.

Nutritional Value – Processing tomatoes are are a nutrient dense food. One, four-ounce tomato supplies about one-third of the recommended daily allowance for vitamin C, plus contains beta-carotene, potassium, folic acid, and other B vitamins, iron, and fiber. Tomatoes are a naturally low-calorie food.

Studies show processing tomatoes are the leading source of lycopene in the American diet. Lycopene, the ingredient that makes tomatoes red, is an antioxidant that blocks cellular damage and is highly effective in preventing cancers. Tomatoes do not lose their health benefits as they are processed and cooked. In fact, lycopene in cooked and processed tomatoes (sauce, paste, salsa, canned tomatoes) is more easily absorbed than fresh tomatoes. This fact, along with their popularity, makes tomatoes a leading nutritional source in the American diet.

For additional information:
California Tomato Growers Association, Inc.
(916) 925-0225
www.ctga.org

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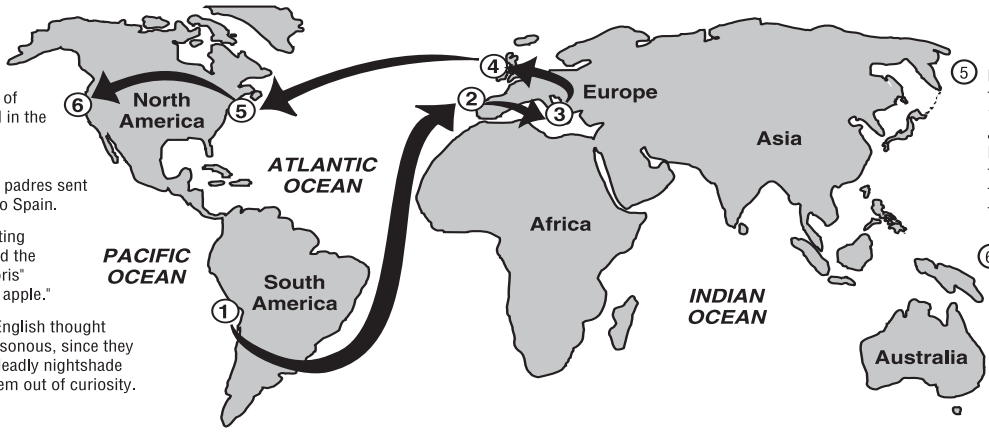
Processing Tomato Activity Sheet

The Tomato's Journey to North America



1. Tomatoes, the size of cherries, grew wild in the Andes Mountains.
2. In the early 1500s, padres sent the tomato seeds to Spain.
3. Italians enjoyed eating tomatoes and called the tomato "poma amoris" which means "love apple."
4. In the 1600s, the English thought tomatoes were poisonous, since they are related to the deadly nightshade plant, and grew them out of curiosity.
5. English colonists brought the tomato to America in the mid-1700s. In 1820, Robert Gibbon Johnson stood on the steps of a New Jersey courthouse, ate a tomato, and lived. Americans finally believed tomatoes were tasty and not deadly.
6. In the 1950s, mechanical harvesters were developed. Scientists began developing tomatoes with tougher skins, fewer seeds and less juice. They also were more rectangular in shape, and greater in yield.

Lesson Ideas

- Label and color the top seven counties in California for processing tomato production.
- Make a collage from labels of various processed tomato products.
- Make a Venn diagram which compares processing tomatoes to fresh market tomatoes.
- Find out why a tomato is scientifically a fruit but is also known as a vegetable.
- Create a class cookbook which includes favorite student recipes using a tomato product.
- Research the Spanish exploration movement of the 1500s. What other "treasures" came from the New World?
- Locate your nearest tomato processor. Where do the tomatoes they process come from?

Fantastic Facts

1. California leads the nation in processing tomato production.
2. Processing tomatoes are harvested by machines.
3. Processing tomatoes have thicker skins than fresh market tomatoes so they can be mechanically harvested and successfully transported.
4. There are 2,750 different varieties of tomatoes.
5. Tomatoes were once thought to be poisonous.
6. Processing tomatoes are rich in vitamin A, vitamin C, potassium, folic acid, beta-carotene, iron, B vitamins, and fiber.
7. The first tomatoes originated in the South American Andes and were berries the size of cherries.

Lesson Plan: pH Perfection

Introduction: When food is preserved, the microorganisms causing food spoilage are destroyed or slowed down. This is done by using extreme temperatures, changing the moisture level, or altering the acidity of the foods. The temperature of canning is extremely important for safety reasons. Foods with a pH higher than 4.6 must be canned at 240ºF or greater. Foods that are more acidic, having pH measurements less than 4.6, may be preserved at 212ºF. This difference in temperature can affect food taste and cost.

Objective: Students will conduct an experiment to determine the ideal temperature for canning tomatoes.

California Standards: NGSS: 5-PS1-3, MS-PS1-4

Materials: Lemon, pear, carrot and tomato juice, litmus paper which shows varying pHs, six paper cups or test tubes, forceps.

Procedure:

1. Discuss reasons and ways people preserve food. Talk about the importance of acidity and heat in canning.
2. Explain what pH is and how scientists determine the pH of a substance. Talk about the indicator litmus and how it will be used.
3. Pour an equal amount of each substance to be tested into a cup or test tube.
4. Using the forceps, have the students dip one piece of litmus into one substance and record its pH. Repeat this procedure for each juice.
5. Discuss which foods could be preserved at the lower temperature and which need to be canned at the higher temperature. Where do tomatoes fall in this test?
6. What could be done to the foods to change their pHs? When do you think scientists should check the pH of the item to be canned?

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Commodity Fact Sheet

Prunes

Information compiled by the California Prune Board

How Produced – A prune tree starts to bear fruit four to six years after planting and reaches its full production capacity (150 to 300 pounds of raw fruit per year) sometime between its eighth and twelfth year in the ground. The tree will continue to bear quality fruit on a commercial basis for about 30 years. Typically, the orchards are ready for harvesting between mid-August and early September, which generally takes about 30 days. Harvest time is determined by fruit ripeness, since plums are one of the few fruits allowed to fully tree ripen before they are picked.

Today, the majority of California Prunes are machine harvested. The fruit is shaken off the tree and transferred via conveyor belt into bins which then go to the dehydrator. The tree-ripened fruit is washed, placed on wooden trays, and dehydrated—three pounds of fresh fruit then becomes one pound of dried fruit. From the dehydrator, the prunes go to packing plants where they are graded for size, inspected, and stored to await final processing and packaging. Unlike most processed fruits, prunes are often packed to order. With each order, the prunes are re-hydrated, sterilized, put through a final inspection, and packaged for shipping.

History – During the Gold Rush, a Frenchman named Louis Pellier came to California, but he didn't find much gold, so he decided to try growing prunes instead. He attached part of the French plum tree to a wild American plum tree—a practice that farmers call "grafting"—and created the "Improved French" variety that California still grows today. These trees grew so well in California that others soon caught on, and orchards began popping up all over the state from the Santa Clara and San Joaquin Valleys to Sacramento, Sonoma, and Napa.

The turn of the century brought rapid ups and downs and one farmer tried to remedy a labor shortage by using 500 monkeys for cheap labor. The monkeys were surprisingly reliable at picking the fruit, but they ate the crop. In the 1950s the industry replaced prewar harvesting methods with more innovative practices and modern machines while high- tech companies started to colonize the Santa Clara Valley—now known as "Silicon Valley"—pushing farmers into other regions making the Sacramento Valley the new epicenter for prunes. The next six decades brought new ways of marketing and promoting prunes paving the way for nutrition and culinary research and contemplation of changing the name from prunes to "dried plums." The alternative never entirely took root, and today the commodity board proudly promotes all the wonders of California prunes.

Varieties – Although all prunes are plums, not all plums can be prunes. Only certain varieties can be dehydrated the right way, turning them into prunes. California prunes are the "Improved French" variety of plums, an offshoot of La Petite d'Agen, a plum native of Southwest France. The high sugar content of the California variety allows it to be dried without fermentation occurring around the pit.

Commodity Value – California is the world's largest prune producer growing more than 90% of the United States' supply and about 40 percent of the world's prunes. Today, California has more than 36,000 bearing acres of prune orchards producing an average of 80,000 tons each year. California exports to more than 60 different countries–Europe, Canada, Japan, and China are among the top exports. The crop value of the California prunes is approximately $160 million annually.

Top Producing Counties – Most prunes are grown in the Sacramento and San Joaquin valleys where the rich soil and the long warm season provides ideal growing conditions. The leading counties are Sutter, Butte, Yuba, Tehama, and Glenn.

Nutritional Value – A serving of four to five prunes has 100 calories, are naturally sweet and have no added sugar providing antioxidants, potassium, fiber, and other important vitamins and minerals. These nutrients may help reduce the risk of some chronic diseases. Prunes are naturally fat-free and have no cholesterol and no sodium. Macronutrients like carbs and soluble fiber found in prunes energize muscles and delay hunger during exercise. Prunes help support bone health and the nutrients in prunes including boron, potassium, vitamin K, copper, fiber, and polyphenols work together to protect the bone.

Prunes make an easy snack–ready to eat, no prep required, and count as a serving of fruit. Prunes also work well as a fat substitute and can reduce sugar in baked goods.

For additional information:
California Prune Board(916) 749-3442
Website:
www.californiaprunes.org

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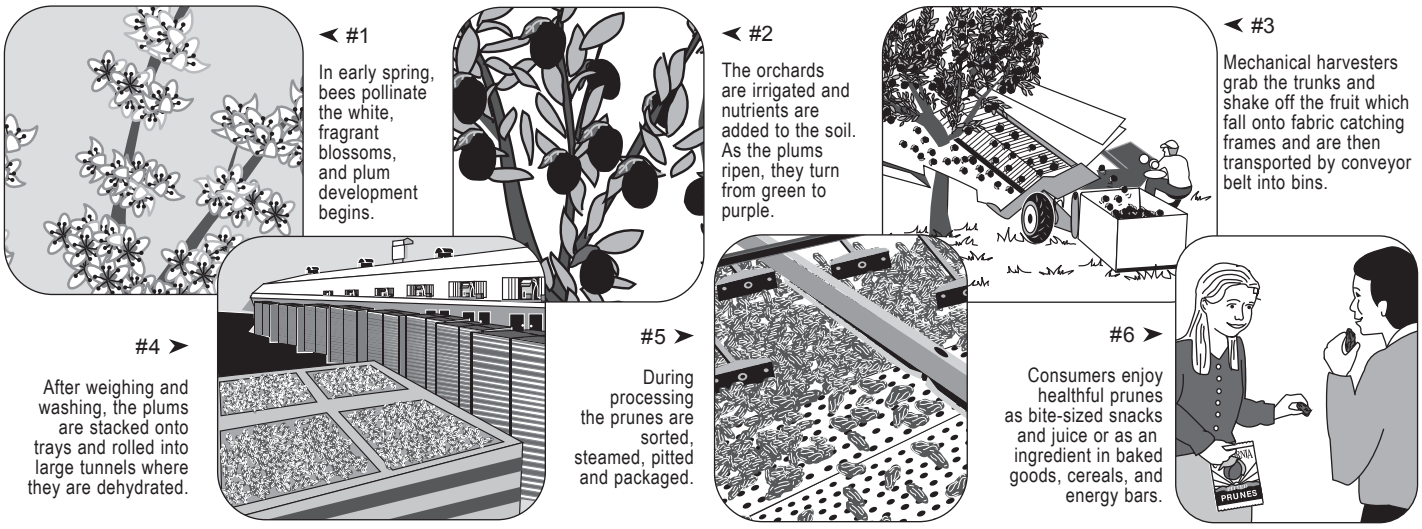
Prune Activity Sheet



#1 In early spring, bees pollinate the white, fragrant blossoms, and plum development begins.

#2 The orchards are irrigated and nutrients are added to the soil. As the plums ripen, they turn from green to purple.

#3 Mechanical harvesters grab the trunks and shake off the fruit which fall onto fabric catching frames and are then transported by conveyor belt into bins.

#4 After weighing and washing, the plums are stacked onto trays and rolled into large tunnels where they are dehydrated.

#5 During processing the prunes are sorted, steamed, pitted and packaged.

#6 Consumers enjoy healthful prunes as bite-sized snacks and juice or as an ingredient in baked goods, cereals, and energy bars.

Lesson Ideas

- Keep a daily journal tracking the food you eat throughout the week. Compare your daily servings of fruits and vegetables to those recommended by USDA's MyPlate. Set an attainable goal to increase your fruit and vegetable consumption.
- Visit choosemyplate.gov to investigate the nutritional value of fresh vs. dried fruits. Determine if there is enough fruit in your daily diet.
- Devise an advertisement which promotes eating prunes.
- Research the importance of bone health as a youth and into adulthood
- Research the science of dehydration and learn its benefits as a food preservation method.
- Invite a prune producer or grower into your classroom to discuss his or her profession.
- Reduce, replace, reward–try making an easy prune puree as a swap for some of the fat and sugar in cookies or muffins.

Fantastic Facts

1. Prunes are simply plums grown on trees in orchards and dried in large ovens called tunnels.
2. California prunes are harvested by mechanical shakers.
3. The first prune orchard was established in Santa Clara county, California now known as the Silicon Valley.
4. During a labor shortage in 1905, a prune grower tried to use 500 monkeys to pick the fruit.
5. Prunes are fully ripened on the tree, so farmers determine harvest time by checking fruit firmness and sugar content.
6. Three pounds of fresh fruit makes one pound of prunes.
7. Water is added to dehydrated prunes before they are packed for consumers.
8. Commercial prune trees are productive for approximately 30 years.
9. Prunes are a healthy snack that count as a full serving of fruit.

Lesson Plan: Healthier Baking Cookbook

Introduction: Now more than ever, people have realized the health benefits of having a strong immune system, reducing fat and sugar intake, and including a minimum of five servings of fruits and vegetables each day.

Objective: Students will analyze some of their favorite recipes and see how they can make their favorite dessert a healthier snack.

California Standards: CC ELA: W.3-8.4, RST.6-8.3, 9, WHST.6-8.4, 10; CC Math: 3.NF.3, 4-5.NF.4; NGSS: 5-PS1-2, 3, 4

Materials: One cup (8 ounces) Prunes, water, blender, one packaged brownie mix with required ingredients, one favorite baked snack recipe from each student, blank paper, markers, construction paper.

Procedure:

1. Make a puree by blending one cup of prunes and six tablespoons of hot water in a food processor or blender. This makes one cup of prune puree. Use half the butter or oil called for in the recipe. Replace the remaining amount of butter eliminated with half of the measurement of puree. If a recipe calls for one cup butter, use ½ cup butter and ¼ cup prune puree.
2. Have the students taste the brownies and comment on their flavor. Explain what you did to make them lower in fat.
3. Have the students bring in one or two of their favorite brownie, cake, or cookie recipes and rewrite the recipe using prune puree (see step 1). Encourage the students to try their new recipes at home. Works best with dark colored baked goods.
4. Create a class cookbook of the low-fat recipes. It may include a recipe from each student with illustrations, and quotes from students and parents who tried the new recipes.

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Commodity Fact Sheet

Rice

Information compiled by the California Rice Commission

How Produced – In March, farmers begin to prepare their fields for planting. Fields are carefully leveled with precision, GPS-guided grading equipment. Level fields allow rice farmers to conserve water. Fertilizer is then added, and shallow furrows are rolled into the field. Next, rice seed is soaked and loaded into planes. Flying at 100 miles per hour, planes plant the fields from the air. The heavy seeds sink into the furrows and begin to grow. The high-tech land leveling and recirculating irrigation systems have allowed farmers to maximize yields and improve water use efficiency by more than one-third in the last 30 years.

© California Rice Commission

It takes rice plants four to five months to reach maturity. The rice grows rapidly, ultimately reaching a height of three feet. By September, the grain heads are mature and ready to be harvested. On average, each acre will yield more than 8,000 pounds of rice. Farmers drain the fields and use mechanical harvesters to collect the ripe grain. Harvesters are designed to both gently and rapidly bring the grain in from the fields. Specialized tractors, or bankout wagons, come alongside to receive the rice and deliver it to waiting trailers.

Finally, the rice is dried to an ideal moisture level and processed. At a rice mill, it undergoes various stages of processing. Brown rice is the result of simply removing the hull, which covers the grain. White rice is the result of removing the bran layers to leave just the inner, pearly grain.

California rice fields are home to hundreds of wildlife species and is the only crop that replicates the once-abundant wetlands. Ducks, geese, and shorebirds by the millions rest and feed in California ricelands during the annual migrations. Most recently, it was determined that nearly 230 species of wildlife are sustained by California rice growers.

History – It is believed that rice was first cultivated in ancient Asia and from there spread to Africa and Europe. Rice was later introduced to South and North America and Australia with the advent of sea voyage.

Rice farming in California began in the early 1900s, mainly in response to the increasing Chinese population during the Gold Rush. California rice farmers were able to provide the staple of the immigrants' diet and solve the problem and expense of having the grain shipped from China or Japan.

Varieties – Rice is grouped by size: long, medium, or short grain. Most rice grown in California is medium grain, japonica, which is best suited to the state's temperate growing conditions. Japonica rice is prized by many for its unique taste. California medium grain rice is soft, clings together, and is slightly translucent which makes it well suited for Asian cuisine, paella, risotto, and desserts.

Commodity Value – The California rice industry provides thousands of jobs and contributes more than $920 million to the state's economy each year. Approximately half of California's rice crop is sold in domestic markets including breakfast cereals, baby food, rice cakes, beverages, and table rice. The remaining half is exported around the world. Top export markets for California rice include Japan, South Korea, Jordan, Saudi Arabia, and Israel. In 2020, California production totaled nearly 4.5 billion pounds of rice. California grows 30 percent of the rice produced in the U.S., second only to Arkansas.

Nutritional Value – More people around the world eat rice as the primary staple of their diet than any other single food. Rice is a nutritious, affordable source of carbohydrates, and is packed with vitamins and minerals. It includes thiamin, riboflavin, niacin, phosphorus, iron, and potassium, and is an excellent source of amino acids. Only a trace of fat is found in either brown or white rice. Experiments have shown that brown rice and rice bran may help reduce cholesterol in the blood. Brown rice is a good source of fiber and an essential ingredient in a healthy diet.

For additional information:
California Rice Commission
(916) 387-2264
Website: www.calrice.org

California Rice
THE ENVIRONMENTAL CROP

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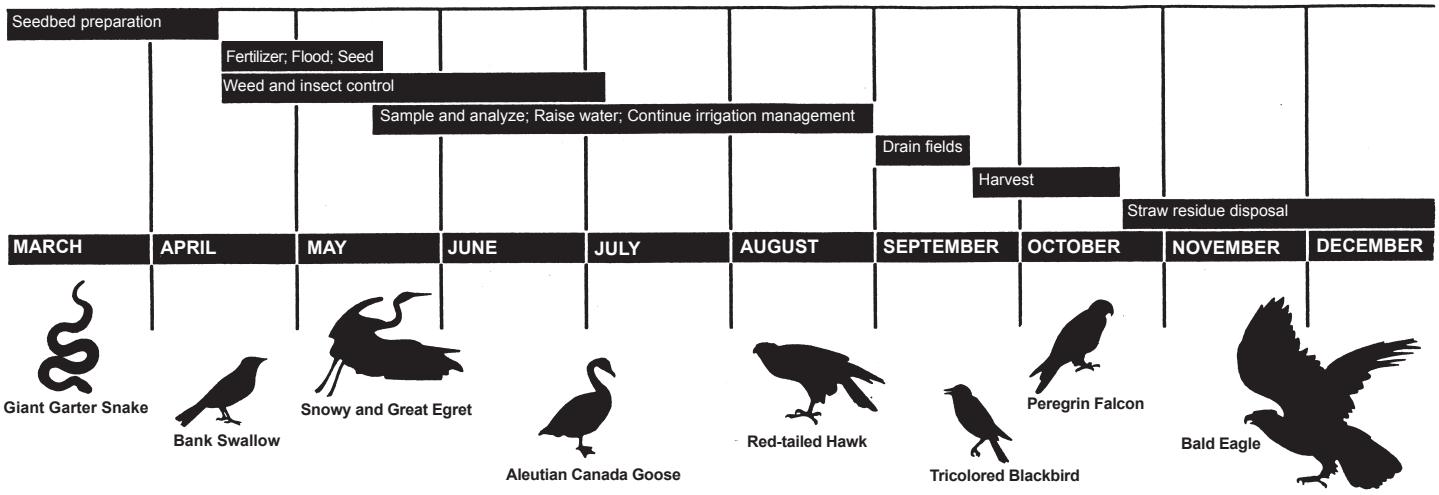
Rice Activity Sheet

Rice Life Cycle

CALIFORNIA CALENDAR OF RICE OPERATIONS AND WILDLIFE



Lesson Ideas

- Find five items at home whose main ingredient is rice.
- Using a calorimeter, compare the caloric content of brown rice and white rice.
- Create a mosaic using naturally and artificially colored rice.
- Research the various types of rice and their uses.
- Research the climatic and environmental characteristics necessary to grow rice.
- Discuss the various uses of rice straw (ethanol, straw board, straw bale homes).
- Create a class book that describes the growing and processing of rice.
- Write a poem that begins with the sentence “I think rice is nice!”
- Research the properties of gluten and compare the gluten content of short, medium, and long grain rice.
- Determine the energy transfer available from rice straw.

Fantastic Facts

1. Most rice fields in California are planted by airplane.
2. California grown rice is used for processed products such as baby food, rice cakes, beverages, and table rice.
3. Rice farmers conserve water by recirculating irrigation water and using laser-guided grading equipment to level fields.
4. It takes four to five months for rice to reach maturity.
5. Nearly 230 species of wildlife are sustained by California rice growers.
6. *Japonica* rice is the most common variety grown in California because it is well-suited to the state’s temperate growing conditions.
7. Thiamin, riboflavin, niacin, phosphorus, iron, potassium, amino acids, and fiber are nutrients found in rice.

Lesson Plan: A Journey Through the Rice Mill

Introduction: In order for the harvested rice to be edible, the hulls must be removed to reduce the amount of unusable materials and to prevent the rice kernels from germinating. White rice is obtained by milling further to remove the rice bran. This leaves the rice with a soft texture which reduces cooking time.

Objective: Students will replicate the process of rice milling by turning rough rice into milled white rice. Students will research the commercial process and summarize their findings in paragraph form.

California Standards: CC ELA: W.3-12.4, 7, 8; RI.3-4.3; RI.6-12.2

Materials: Two mouse pads or flat rubber pieces, two pieces of 70-100 grit sand paper, rough rice.

Procedure:

A. Turning rough rice to brown rice:

- Have students place a mouse pad or piece of rubber on the desk.
- Place several pieces of rough rice on mouse pad or rubber piece and lay the second mouse pad or rubber piece on top.
- Rub the two pieces back and forth until all of the hulls are removed from the rice kernels.

Rice hulls are often burned in biomass plants to produce energy or incorporated into animal feed. Brown rice is packaged and sold.

B. Turning brown rice to milled white rice:

- Place one piece of sandpaper flat on the desk.
- Place several kernels of brown rice on sandpaper and lay a second piece of sandpaper on top.
- Rub the two sheets of sandpaper together for 3-5 minutes.

When finished, the students will be able to observe two distinct rice products—milled white rice and rice bran. Rice bran is used as an additive in several different food products.

04/22 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Spinach

Information compiled by Fresh Express

How Produced – Before planting, the farmer will till and prepare the soil. Spinach can be grown on a variety of soil types but the best crops come from sandy loam soil, which is usually found along rivers. The sandy ground makes harvesting easier after rainfall because of good drainage. Drainage quality also affects the irrigation cycle. Since spinach is not a deep-rooted crop, it relies on frequent irrigations to maintain the proper soil moisture levels for ideal growth.

Approximately 90% of U.S. spinach is grown in California and Arizona. Spinach grows best during cool periods of the year. Almost 50% of spinach produced in California is grown in the Salinas Valley in Monterey County, where spinach is produced from February through November. Spinach is a quick-growing, cool-season vegetable that grows best at temperatures from 45ºF to 75ºF. The foggy and cool summers of the California central coast and the clear and cool winters of the Arizona desert provide ideal growing conditions for spinach.

Spinach is planted relatively shallow at about ½ - to ¾ - inch depth and at high seed densities of 21 to 48 seed lines per 80-inch beds. These high seed densities result in about 3.5 million plants per acre. Spinach can be harvested in the Salinas Valley 21 to 50 days after planting. Spinach is grown for fresh market (bunched or packaged) and for the processing (frozen) industry. Most of the spinach is mechanically harvested using a machine with a front cutter bar. After harvesting, spinach is typically cooled to 34ºF at centralized cooling facilities before being transported to the processing plant. Spinach has a very high respiration rate and is therefore quite perishable. If kept at low temperatures, spinach can be stored for 14 to 18 days.

History – Spinach has been consumed for thousands of years. It is believed that spinach made its way into Indian and Asian cooking through Arab traders who carried it to Asia from the Middle East. In the 11th and 12th centuries, spinach became a popular vegetable in Spain, and from there it diffused to Germany, Italy, England, and France. It has been used in salads, soups, in baked dishes with cheese, yogurt, and in tortellini. In the early 19th century, American colonists introduced spinach to North America. At least three varieties were grown by 1806. With the development of canning and freezing, the popularity of spinach increased world-wide. The increase in spinach consumption in the U.S. has been due to the sale of freshly packaged teen and baby spinach.

Varieties – Types of spinach are classified as smooth leaf, savoy, and red veined. California grows all three. Smooth leaf varieties have a mature leaf length of about six inches. Savoy spinach is very crinkly and has the same sized leaf as the smooth leaf variety. Red veined spinach has a smaller leaf, similar to the all-green baby leaf types, but with additional color and nutrients associated with the color red in the leaf veins. There are many varieties in each type of spinach. Popular varieties in California include Avenger, Bolero, Bossanova, Dolphin, Emilia, Falcon, Lazio, Palco, Unipak, and Whale. Varieties are constantly being developed and may replace these currently popular ones.

Commodity Value – The acreage of fresh market spinach in California has increased from 25,000 acres in 2009 to 42,100 acres in 2020. In 2020, the total crop volume for spinach (fresh market and processed) was 505 million pounds. California accounts for 69% of the nation's total spinach production. Spinach ranks number 27 among all commodities grown in California.

Top Producing Counties – The top counties in 2020 for spinach production in California were Monterey (51.6%), Imperial (17%), San Benito (13%), Ventura (6%) and Riverside (6%).

Nutritional Value – Fresh spinach is a good source of anti-oxidant vitamins like A and C and phenolic antioxidants like lutein, zeaxanthin, and beta-carotene. These compounds are scavengers against free radicals and play a healing role in aging and different diseases, including cancer, and promote normal eye-sight. Spinach is an excellent source of vitamin K, which is important for strengthening the bone mass. It also contains vitamin B6 and folates.

For additional information:
Fresh Express
800-242-5472
Website: www.freshexpress.com

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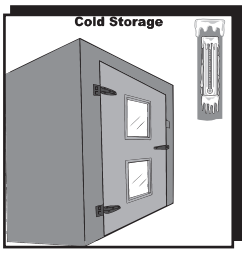
Spinach Activity Sheet

➤ #1

Food safety specialists carefully examine field conditions, monitoring crop quality and food safety compliance prior to planting, and during production and harvest.



➤ #2

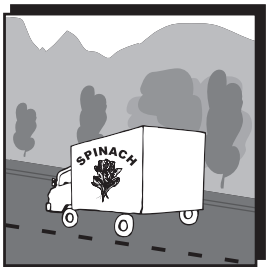
Cold temperatures are criti-cal to freshness. Growers cool down spinach within hours of harvesting and keep it chilled from the field to the store.

➤ #3

From the field, spinach is transported to packaging facilities where it is thoroughly washed, rinsed, and gently dried. Often spinach is packaged in a breath-able bag for long-lasting freshness.

#4 ➤

After packaging, spinach is transported swiftly and safely to retail locations across the country. Maintaining consistent cold temperatures is important so every refrigerated truck is monitored throughout its journey to ensure spinach stays cool, fresh, and delicious.



#5 ➤

Consumers enjoy eating spinach. Everyone knows that fresh spinach makes a delicious side dish, but it also makes a nutritious meal on its own.

Lesson Ideas

- Locate on a Western U.S. map where spinach is predominantly grown. What are the climatic differences or similarities?
- Based on the total pounds of spinach produced in California in 2020, how many pounds would have been grown in Monterey County? How many tons is this?
- Illustrate the process of photosynthesis and explain the role chlorophyll plays in spinach growth.
- Compare and contrast the nutritional value of spinach to other leafy greens such as mizuna, iceberg lettuce, and arugula.
- Create a delicious recipe using spinach and provide a cooking demonstration for the class. Explain safe food preparation and give everyone in the audience a sample.

Fantastic Facts

1. The three main spinach varieties are Smooth Leaf, Savoy, and Red Veined.
2. It takes 21 to 50 days for a spinach plant to mature.
3. After harvest, spinach is cooled to a temperature of 34 degrees F.
4. Spinach is a significant source of vitamin A, vitamin C, vitamin B6, vitamin K, folate, beta-carotene, lutein, and zeaxanthin.
5. The best spinach crops come from sandy loam soil, which has good drainage and makes harvesting easier.
6. The Salinas Valley produces the most spinach in California.
7. California grows 71.5% of the nation's total spinach.
8. Spinach originated as a food crop in the Middle East.

Lesson Plan: Steamed or Raw?

Introduction: Spinach is packed with nutrients, easy to prepare and tasty too! In fact, spinach can be prepared many different ways. This activity will encourage students to add spinach to their diets.

Objective: Students will compare the visual appearance, taste, texture, and smell of fresh and steamed spinach.

California Standards: CC ELA: W.3-12.7; WHST.6-12.2, 7 NGSS: 5-PS1-2; MS-PS1-2

Materials: Raw and steamed spinach (prepared before or during class), paper plates, forks, napkins, observation journals, pencils.

Procedures:

1. After students wash their hands, instruct them to use all their senses to observe the raw spinach. Keep in mind color, texture, smell, sound, and taste. Students may record observations in their journals.
2. Repeat the observation activity above with steamed spinach.
3. Research and compare the nutritional value of raw and steamed spinach. Discuss why the nutritional values differ and investigate the chemical processes involved in cooking spinach.
4. Determine the differences in serving size for raw and steamed spinach.

   one cup raw = __ cup steamed

5. Ask students to explain which type of spinach they liked best and why. Discuss the balance between choosing the most nutritious product and personal taste preference.
6. Optional: Give students the opportunity to compare the qualities and nutritional value of canned and frozen spinach too.

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This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Strawberries

Information compiled by the California Strawberry Commission

How Produced – Strawberries thrive along California's coast because western ocean exposure and Pacific winds insulate the fields from extreme temperatures and weather, providing the ideal conditions for growing strawberries almost year-round. Strawberry plants are grown in stock nurseries and then transplanted into fields where they grow for another three months before they begin producing fruit. Strawberries are grown all year long in California, with the peak strawberry season occurring from April through August when volume rises from about two million trays per week to over eight million trays. That is about 72 million pounds per week.

All strawberries are picked, sorted, and packed in the field by hand. Trays of strawberries are then rushed to shipping facilities where they are cooled to 32°F. Within 24 hours of harvest, fresh market strawberries are loaded on refrigerated trucks for delivery across the country. This unique and sophisticated distribution system ensures this highly perishable fruit reaches consumers in fresh-from-the-field condition.

History – Strawberries can be traced back as far as the Romans, and perhaps even the Greeks. Medieval stonemasons carved strawberry designs on alters and around the tops of pillars in churches and cathedrals, symbolizing perfection and righteousness. During the same time period, strawberries were served at important state occasions and festivals to ensure peace and prosperity.

The most common explanation for how the strawberry got its name is that children in the nineteenth century threaded the berries onto straws and offered them for sale. Fresh strawberries began to flourish in California in the 1950s due to improved cultural technologies.

California strawberry growers are leading research in ways to conserve water, protect the soil, and reduce fertilizer and pesticide use. One of the first agricultural groups to adopt drip irrigation technology to conserve water, they continue to invest millions of dollars in non-chemical farming methods. Progressive and sustainable farming practices include innovative integrated pest management (IPM) strategies that work with nature to control pests, advanced irrigation management practices, and new strawberry varieties that resist pests and diseases.

Varieties – Different varieties are suited to particular climates and growing regions. Southern California varieties are adapted for warmer temperatures and shorter daylight hours for early fruit production. Northern varieties have been selected for a longer production cycle, which extends through the fall. For more than 70 years, commercial varieties have been developed by pomologists at the University of California. Successes include the development of new commercial strawberry varieties now grown throughout the world and precedent-setting solutions to disease and pest control.

Commodity Value – Strawberries are among the top three most frequently consumed fruits, and consumption is steadily increasing. Kids and adults report strawberries as their favorite fruit, with U.S. household consumption rising to nearly 71 percent. In 2021, strawberries produced in California accounted for 88% of the U.S. strawberry production. Over 38,000 acres are devoted to strawberry production in California. Canada and Mexico are primary export markets for fresh and frozen California strawberries. Today, strawberries represent a $2.8 billion industry in California.

Top Producing Counties – California harvests more than two billion pounds of fruit annually. The leading counties in strawberry production include Santa Barbara, Ventura, San Diego, Monterey, Santa Cruz, and San Luis Obispo.

Nutritional Value – California strawberries are an excellent source of vitamin C, providing more than 100% of the recommended daily value, and are a source of potassium, folate, and fiber. Naturally low in sugar, a one-cup serving of strawberries has only 45 calories and fits well in a diabetes meal plan. Research shows eating eight strawberries a day may support heart and brain health.

For additional information:
California Strawberry Commission
(831) 724-1301
Website: www.californiastrawberries.com

CALIFORNIA STRAWBERRY COMMISSION

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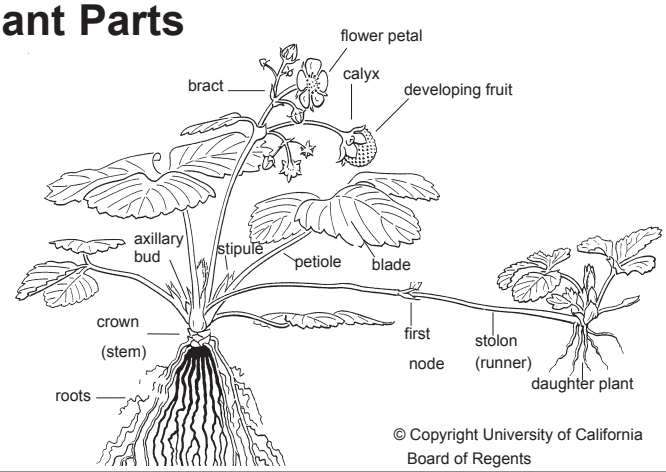
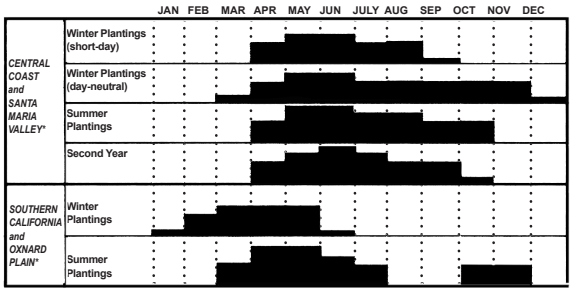
Strawberry Activity Sheet

Plant Parts



Growing Season and Peak Production



*** Strawberries are also grown in the San Joaquin and Central Valleys.**

Lesson Ideas

- Create a map of California highlighting the major counties where strawberries are grown.
- Estimate the number of seeds on a strawberry and devise a simple method for determining the number of seeds.
- Calculate the surface area and volume of a strawberry.
- Discuss different pests that affect strawberry production and methods for controlling these pests.
- Devise a method of estimating the quantity of strawberries produced on an acre of land.
- Write a paper entitled, "California—The Strawberry Capitol of the United States." Use *www.calstrawberry.com* for your research.
- Discuss the advantages and disadvantages of hand and machine harvesting. Invent a machine to harvest strawberries.
- Analyze the economic impact export markets have on the California strawberry industry.

Fantastic Facts

1. The average strawberry has 200 seeds.
2. Strawberries are harvested by hand.
3. Strawberries are typically propagated using vegetative reproduction.
4. One serving of strawberries contains more than 100% of the recommended daily value for vitamin C.
5. Strawberries do not continue to ripen after harvesting.
6. During California's peak production, 72 million pounds of strawberries can be picked in one week.
7. An average acre of California farmland can produce 21 to 27 tons of strawberries.
8. Strawberries are perennial plants, but are often planted annually.
9. California grown strawberries account for 88% of the nation's production.

Lesson Plan: Make Your Own Strawberry Leather

Introduction: Strawberries can be used to make several tasty and nutritious snack foods.

Objective: Students will demonstrate measuring, food processing, and food safety skills as they make a strawberry treat.

California Standards: CC ELA: RI.3-5.3, 4; RST.6-12.3, 4
CC Math: 3-4.MD.2, 5.MD.3

Materials: Strawberries (1½ cups per group of 4 students), light corn syrup, lemon juice, jelly roll pan, blender or food, masking tape, food processor, plastic wrap.

Procedure:

1. Place 1½ cups of clean strawberries in a blender or food processor and process until smooth.
2. Stir in ½ teaspoon lemon juice and 1½ teaspoons light corn syrup.
3. Line a jelly roll pan with heavy-duty plastic wrap, taping the plastic wrap to the corners of the pan with masking tape.
4. Pour the strawberry mixture into the pan, spreading evenly. Leave at least a one-inch margin on each side.
5. Dry in an oven at 150°F for seven to eight hours or until the surface is dry and no longer sticky.
6. Remove the leather and plastic wrap from the pan while still warm (hands must be clean and dry) and roll up in a jelly roll fashion. Cut into logs and store in plastic wrap for a maximum of five days. Have the students take their strawberry leather home or enjoy it as a class snack.
7. Math extension: Write the cooking measurements in standard units, such as milliliters, liters, or cubic units.

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Commodity Fact Sheet

Table Grapes

Information compiled by the California Table Grape Commission

How Produced – Growing fresh market grapes is a year round job. Growers vigorously prune the vines in the winter. In the spring, buds appear, shoots emerge and grow, cluster florets develop, and flowers begin to bloom when daytime temperatures reach approximately 68°F. As the flowers die, fruit set follicles and tiny green berries appear. These will eventually grow and ripen into mature clusters of grapes. In late spring, the farmers girdle the vines of many varieties, stripping a small ring of bark from the shoots, canes, or trunks. This forces nutrients from the vines and roots into the fruit, resulting in larger berries.

When grape berries achieve the correct size, sugar content, and color, clusters are harvested by hand with special clippers. Harvest usually occurs in late spring to mid-July in the warm desert area of the Coachella Valley. In the San Joaquin Valley, harvest begins in late June and continues through late fall. At harvest, the clusters are trimmed and inspected, packed into shipping boxes, palletized, and transported to a cold storage facility to quickly cool the grapes. Grapes that are not immediately shipped to market are maintained in a controlled climate storage facility between 30°F to 32°F with 90 to 95% relative humidity. This storage process allows consumers to enjoy California table grapes through January.

History – Viticulture, or the science, production and study of grapes, first began in California in the late 1700s when Spanish friars arrived to establish Catholic missions. Because the native grapes were sour and made poor wine, the friars brought over grapes from Europe and planted their own vineyards to make sacramental wine.

In the mid-1800s, prospectors poured into California. They came looking for gold until some discovered that there might be more money in grapes. Shortly after the Gold Rush, California's fledgling agricultural society declared, "Capital put into vineyards would bring greater rewards than... fluming rivers for golden treasures." Their instincts were good. California's warm, dry climate turned out to be ideal for growing grapes. Today, more than 689,000 acres across California are planted with fresh grape, wine, and raisin vineyards.

Varieties – California produced 1.8 billion pounds of table grapes in 2021. To give an idea of the total crop production, the2021 season of California table grapes supplied an average of 4.2 pounds per person. There are 80 varieties of table grapes grouped into three color classifications: green, black and red. The numerous varieties enable consumers to have fresh California table grapes from May through January.

Commodity Value – In 2021, the total crop value of fresh grapes in California was 2.14 billion dollars. Typically, 20 to 30% of California's table grapes are exported to countries around the world. The top five export markets by volume include Canada, Mexico, Japan, South Korea, and Taiwan.

Top Producing Counties – California produces 99% of the nation's commercially grown table grapes. California's table grapes are produced in the Coachella and San Joaquin Valleys, which include Fresno, Kern, Kings, Madera, Riverside, and Tulare counties.

Nutritional Value – Grapes of all colors make a healthy snack. A serving of grapes ($^3/_4$ cup) is just 90 calories, has no fat or cholesterol and virtually no sodium. Grapes are an excellent source of vitamin K, and contain 7% of the recommended daily intake for potassium. Fresh grapes are also a natural source of beneficial antioxidants and other polyphenols. Research shows that grape polyphenols may help maintain a healthy heart. It is recommended that people consume a "rainbow" of naturally colorful, whole fruits and vegetables; eating a variety of fresh grapes helps achieve this goal and is a great start to a healthy lifestyle. Eat them fresh by the bunch, tossed into salads, yogurt, and more. Frozen grapes also make a refreshing snack on a hot day.

For additional information:
California Table Grape Commission
(559) 447-8350
Website: www.grapesfromcalifornia.com

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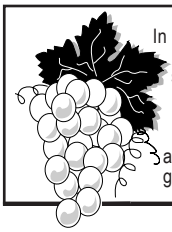
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Table Grape Activity Sheet

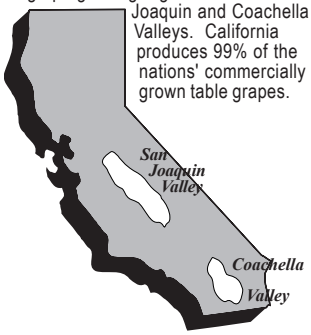
A Little Bit of History

William Wolfskill, a former trapper from Kentucky, planted the first table grape vineyard in 1839. It was located in a Mexican colonial pueblo now known as Los Angeles.

In the 1860s, William Thompson, an English settler, first planted a popular Eastern Mediterranean grape in Yuba City. It is now known as the Thompson Seedless grape.

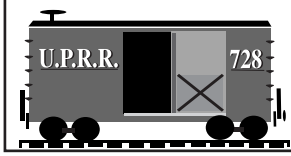


Today, the major California table grape growing regions are the San Joaquin and Coachella Valleys. California produces 99% of the nations' commercially grown table grapes.



In the mid-1800s, Colonel Agoston Haraszthy personally brought 100,000 table grape cuttings to California and planted them to provide fruit to the miners of the California Gold Rush.

In 1869, R.B. Blowers pioneered the transport of fresh table grapes to eastern markets. The first load was shipped by freight train to Chicago. Each grape cluster was wrapped in paper bags, in 22-pound boxes.



Lesson Ideas

- Make a mural depicting the life cycle of a grapevine.
- Research the role of phloem, xylem, and cambium in plants and relate it to the girdling process done on grapevines.
- Use a world map to trace the distribution of grapes over time.
- Compare the latitudes and longitudes of major grape-growing countries and grape-importing countries.
- Compare and sort various grape varieties by color, shape, or size.
- Research the Phoenicians and their importance in the ancient world.
- Use frozen grapes as ice cubes in a favorite drink.
- Compare the etymology of the French word “grape” and the English word “grapple.”

Fantastic Facts

1. Growers harvest grapes when they are fully ripe.
2. The two valleys in California that produce the most fresh market grapes are Coachella and San Joaquin.
3. California produces 99% of the nation’s commercially grown table grapes.
4. There are over 80 varieties of table grapes grown in California.
5. Fresh California table grapes are available from May through January.
6. The three colors of table grapes are green, black, and red.
7. A serving size of grapes is ¾ cup.

Lesson Plan: To Market! To Market!

Introduction: Since 1970, the United States per capita consumption of table grapes has grown from two pounds to close to nine pounds per year. Many factors contributed to this rise, including improved marketing techniques. Developing new marketing techniques relies heavily on research such as surveys and taste tests. In this activity, your students will conduct a survey, analyze the results, and produce a magazine advertisement to sell table grapes.

Objective: Students will conduct a survey, analyze the results, and create an advertisement.

California Standards: CC ELA: W.3-12.4, 7; WHST.6-12.4, 7; SL.3-12.1, 3-12 Visual Arts Content 5.0

Materials: *Table Grape Fact Sheet,* supermarket advertisements for grapes, magazine food advertisements, and red, green and black grapes.

Procedure:

1. Discuss how advertising and product presentation affect the sale of foods. Have students bring in samples of food advertisements from magazine and grocery ads.
2. Discuss the various marketing strategies used to persuade a consumer to purchase a product. Examples may include low prices, convenience, healthy eating, or appealing to the senses. Have the students analyze what strategies are used in the ads brought to class.
3. Have students gather information on grapes by examining and tasting fresh grapes, writing down words that describe the grapes, looking at the cash register receipt from the grape purchase, and reading the *Table Grape Fact Sheet* and other literature you have on grapes.
4. Have the students develop and administer a survey designed to find out what consumers are looking for when buying fresh fruit, in particular, fresh grapes. Possible questions may include: “Who eats grapes in your home?,” “Does price matter in your fruit choice?,” and “What color of grapes do you prefer?”
5. After conducting their survey and analyzing results, have students write magazine or grocery ads to promote their products.

08/22 Learn About Ag

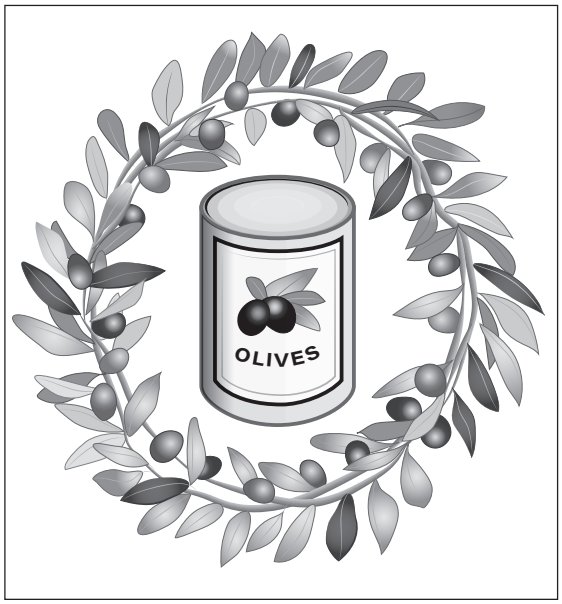
This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Table Olives

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – Planted in hedgerows, it takes three to five years for an olive tree to produce the first fruit, with production continuing beyond 100 years. Most olive varieties are self-pollinating, meaning a single tree can pollinate itself. Other varieties require cross-pollination, relying on bees or wind. In the spring, trees are in blossom, with small cream-colored flowers appearing throughout the orchard. Once pollinated, olives grow in place of the blossom and ripen throughout the summer. During the spring and summer, supplemental water and nutrients are needed to produce optimal fruit and maximize the next year's crop production. During the fall, harvest begins while the olives are still green but starting to darken.



The harvest can vary from under 50,000 tons one year to more than 100,000 tons the next year, depending on the alternate bearing year. Alternate bearing crops have one year with high production followed by a year that produces little to no fruit. Ripe olives are handpicked and sent to one of California's two olive processing plants. There, the olives are sorted, graded, and stored until they are ready to be processed into a variety of olive products.

History – The first documented history of olives dates back to 5000 B.C. in the Mediterranean Basin, originating in ancient Greece. The cultivation and various use of olives and olive by-products were an essential part of civilized life. Cultivating olives became a source of economic sustenance for centuries, generating widespread production. Trees were brought to the Americas by Spaniard missionaries in the 1600s and planted at the Mission Basilica San Diego de Alcalá. It took until the 1800s for commercial cultivation to begin.

In the early 1800s, there was an increase in demand for California olives to be used for oil production. Farmers began planting more trees to meet the demands of consumers, resulting in lower prices for olives from the influx into the market. Farmers then needed to create another source of revenue for their crops due to the influx. Freda Ehmann (1839-1932), an olive grower in Northern California, started to work with a U.C. Berkeley professor to examine processing methods that would extend the shelf life of olives and create a new revenue outlet. Freda experimented with 280 gallons of olives in barrels on her back porch. Thanks to her perseverance, her black olive experiment was a success, initiating the development of the California table olive industry.

Varieties – There are close to 2,000 varieties of olives grown throughout the world, with varietal names describing their location of origin. California table olives are one of two varieties: Manzanillo or Sevillano. These two varieties produce different sizes of olives, giving consumers a choice ranging from small to colossal. The four oldest varieties of olives in the state are Mission, Manzanillo, Sevillano, and Ascolano. These older varieties were used for curing for many years due to their large size.

Commodity Value – California has roughly 15,000 acres devoted to olive production accounting for 95% of all olive production in the United States. Olive producers in the United States grow an average of 66,000 tons over a four-year period on 15,000 acres. The wholesale value of the United States olive production is $72.9 million. Worldwide, the United States ranks thirteenth in olive production. Canada and Japan are the top importers for processed and fresh olives in the world.

Top Producing Counties – There are five major counties in which olives are grown in California. Historically, the San Joaquin Valley has been the largest producer of olives because of the ideal Mediterranean climate. Sixty percent of all California olives are grown in Tulare, Fresno, Madera, and Imperial counties. Forty percent of the total production is grown in Glenn, Tehama, Shasta, and Butte counties.

Nutritional Value – Table olives are rich in vitamins E and A. Vitamin E is a nutrient that is important to vision, reproduction, and the health of your blood, brain, and skin. Vitamin A is needed for new cell growth, healthy skin, hair, tissues, and vision. Table olives are also a good source of fiber, which promotes digestive tract health.

For additional information:
California Olive Committee
(559) 456-9096
Website: www.calolive.org

CALIFORNIA RIPE OLIVES
ENJOYED BY FAMILIES EVERYWHERE

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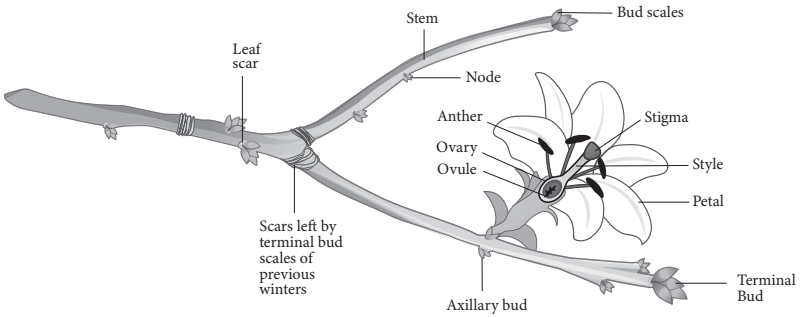
Table Olive Activity Sheet



Pollination occurs in the tree's blossom. Pollen from the anthers (the male part of the plant) is transferred to the stigma (the female part of the plant). Complete pollination fertilizes the ovule and an olive fruit grows.

Lesson Ideas

- Investigate preservation methods used for processed olives.
- Taste test a variety of olives including raw, salted, brined, or flavored.
- Use a map of California to locate the geographical areas where olives are grown. Study the climate, seasons, and weather patterns of these areas and identify similarities.
- Determine how chemistry is involved in processing table olives.
- Make a list of different uses for olives and olive by-products.
- Grow your own olive tree from a cutting. Find step-by-step instructions online, and see if you can propagate an olive tree.

Fantastic Facts

1. Olive trees are evergreen—they do not lose their leaves in the fall.
2. Processing olives below 86 degrees Fahrenheit keeps their aroma and oxidation levels intact.
3. An olive branch traditionally is given to others as a symbol of peace.
4. Olives are classified as stone fruit like peaches, cherries, and plums.
5. Olives are alternate fruit bearing, which means one year a tree will produce much more fruit than the previous year or the next year.
6. The 2004 Athens Olympic torch was designed in the shape of an olive leaf, with the intended message of peace amongst the five continents.

Lesson Plan: History Behind Olives

Introduction: Today olives are grown worldwide and the fruit is incorporated into thousands of products. Historically, the production of olives has contributed to many significant uses such as fueling the torch for the 2004 Olympic Games in Athens, Greece.

Objective: Students will research an olive-related topic, write an informative text, and create a visual display.

California Standards: W.3-12.2,5,7; SL.3-12.4,5

Materials: Access for student use of the Internet and library, display boards or butcher paper, markers and other supplies of your choosing.

Procedure:

1. Divide students into teams of two or three. Have each group select from one of the following topics: the olive tree, table olive production in California, Freda Ehmann and her experiment, the many uses of table olives, the table olive's journey from field to home, other topics of your choosing.
2. Have students explore literature and websites to learn about their olive topic and record their information. Websites may include www.calolive.org, www.olivecenter.ucdavis.edu, and www.agmrc.org.
3. Students will create an informative research report on their topic. Supporting references should be cited and the document should be revised and proofed for accuracy and grammar.
4. Have the students take the information they learned and create a visual display that educates their classmates.
5. Share the displays with the school or public.

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Commodity Fact Sheet

Walnuts

Information compiled by the California Walnut Board

How Produced – After an orchard is planted, it takes approximately four years until it produces its first major crop. Constant attention is given to each tree every step of the way—from pruning, spraying, and fertilizing to irrigation—to ensure a healthy orchard. Once a walnut tree has been planted and stabilized, it will continue to bear fruit for as long as a century.

Harvest begins in September when the protective outer covering, called a hull, splits, signaling that the nuts are ready to be removed from the trees. Nuts are often harvested by a mechanical shaker. After walnuts have been shaken to the ground, they are blown into a row to allow mechanical harvesters to pick them up and take them for cleaning and hulling. The harvest season usually continues into early November.

After hulling and washing, the nuts are transferred into a hopper where they are mechanically dehydrated (air-dried). This protects the nut during transport and storage. Mechanical dehydration is quick, thorough, and scientifically controlled—a major improvement over the sun-drying method formerly used. Walnuts with desirable traits such as big beautiful shells are selected for the in-shell market. Other walnuts are shelled and processed into walnut halves and pieces, and chopped walnuts to be sold in supermarkets and restaurants across the country.

History – Walnuts are recognized as the oldest known tree food, dating back to 7000 B.C. In fact, walnuts are one of only a handful of trees and plants that can be found growing naturally in both eastern and western hemispheres—strong evidence that the trees existed before the continents split apart. Records indicate Persian nuts (English walnuts) were known during the reign of Tiberius. Remains of this nut have also been unearthed in ancient Rome where walnuts were considered food for the gods and called "Juglans Regia" in honor of Jupiter.

The term "English" applied to the Persian nut is a misnomer. The name "English walnut" refers to the English merchant marines whose ships transported the product for trade around the world. It is thought that the first English walnuts were brought to California by missionaries around 1770. Joseph Sexton planted the first commercial walnut orchard in California in 1867, near Goleta in Santa Barbara County.

Varieties – In recent years, Chandler has been the most popular variety used for shelled walnuts. However, there are more than 30 varieties of commercially produced walnuts, hybrids of the English (Persian) walnut. The varieties were developed to have specific characteristics such as early or late harvest times, thin or thick shells, high percentages of walnut meat, or specific pest tolerances. Four varieties account for more than 80% of production: Chandler, Hartley, Tulare, and Howard.

Commodity Value – In California, 380,000 bearing acres, primarily from Redding to Bakersfield, produce more than half of the world's trade in walnuts. California's crop generates more than $958 million in farm gate revenue. Approximately 60% of the crop is exported. Germany, Turkey, Japan, South Korea, and Spain are some of the largest export markets.

Walnut shells can be burned to generate power and heat, or ground and used as pet litter and in sandblasting. In Japan, the shells are used in snow tires to aid traction. Walnut oil is used in gourmet cooking and cosmetics.

Top Producing Counties – San Joaquin County leads production. Other top counties include Butte, Tulare, Glenn, and Stanislaus.

Nutritional Value – The United States Food and Drug Administration affirms that eating 1.5 ounces per day of walnuts as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease. A one-ounce handful of walnuts (12-14 halves) contains good polyunsaturated fats (PUFAs) and is an excellent source of the plant-based essential omega-3 fatty acids ALA (2.5 grams). Walnuts contain many antioxidants (3.721 mmol/oz) and are naturally cholesterol-andsodium free. They also have four grams of protein and two grams of fiber per serving.

For additional information:
California Walnut Board
(916) 932-7070 Website:
www.walnuts.org

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Walnut Activity Sheet

Year 1
Seedling grafted to Paradox or Black Walnut rootstocks. ➤

Year 2
Orchard leveled, irrigation system installed, trees planted. ➤

Years 2-6
Trees pruned, irrigated and fertilized: weeds and insects controlled by biological chemical and/or mechanical, methods; limited nut production. ➤

Years 7-100
Trees produce full crops averaging 1.74 tons/acre.

Harvest
Orchard floors cleaned to remove vegetative growth.
↓
Shaker shakes nuts from trees; walnuts swept into windrows by a sweeper, picked up by harvester and delivered to a huller.
↓
Large wire brushes remove remaining husks from walnuts; walnuts dried to moisture content of 8%.
↓
Walnuts packaged for market or sent to processors.

Annual Practices

September-October
Early harvest begins.

April-August
Fertilizaion, irrigation and pest management strategies implemented.

November
Late harvest completed; orchard floors cleaned; pruning begins.

December-March
Pruning continues; dormant sprays control mites and other insect pests.

Lesson Ideas

- Make a list of different uses for walnuts and walnut by-products.
- Research how walnut shells are used as an abrasive in industrial applications.
- Classify different nuts based on their size, origin, nutritional value, texture, and color.
- Use walnut shells in math and art activities.
- Discuss the importance of polyunsaturated fats. Walnuts are an excellent source of the plant-based omega-3 fatty acid ALA, which are necessary because they cannot be produced by the body.
- Bring products made from walnuts or walnut by-products to class.
- California exports walnuts to more than 100 countries around the world. Find some of these countries on a world map. Use the map scale to determine the distance a walnut travels from California.

Fantastic Facts

1. Walnuts are the oldest known tree food.
2. There is no cholesterol in walnuts, and eating walnuts helps maintain healthy cholesterol in the blood.
3. More than half of the world's walnuts are produced in California.
4. A healthy walnut tree can produce crops for approximately 100 years.
5. By-products of walnuts include cosmetics, oil, sand blasting materials, snow tires, and pet litter.
6. After a walnut orchard is planted, it takes four years to produce the first crop.
7. Walnuts used for the in-shell market must have big beautiful shells.

Lesson Plan: Walnut Shell Dye

Introduction: Walnuts are a delicious and healthful snack, and provide valuable by-products for a variety of purposes. Walnut shells can be burned to generate power and heat or ground up to be used as pet litter, sand paper and snow tires. Processed walnut shells can be used for dyeing fabrics and other textiles, as well as staining wood. The color of the dye will change slightly from harvest season to harvest season depending on the health of the walnut tree and nuts.

Objective: Students will use walnut shells to create a dye for art or woodworking projects.

California Standards: NGSS: 5-PS1-1, MS-PS1-2

Materials: Two cups of walnut shells, one quart water, stove or heating source, large enamel or stainless steel (not aluminum) pot, sturdy wooden spoon, sieve, container to collect dye, fabric to dye.

Procedure:

1. Review class safety procedures before beginning this experiment.
2. In a large pot, combine two cups walnut shells and one quart water. Soak the shells in the water overnight.
3. The following day, boil the shells in the water for one hour. Be careful not to let the water evaporate completely.
4. Use the sieve to strain the mixture and discard remaining shells. Add the fabric to be colored directly into the dye. Let the material soak in the dye until the desired color intensity is reached. The dye may also be applied to hard surfaces using a paint brush.
5. Discuss the scientific concepts that explain the color change, and have students provide evidence for their reasoning. Does the dye contain walnuts? What would happen if all the water evaporated? Are they observing a chemical or physical change?

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